YUKON RIVER BASIN STUDY

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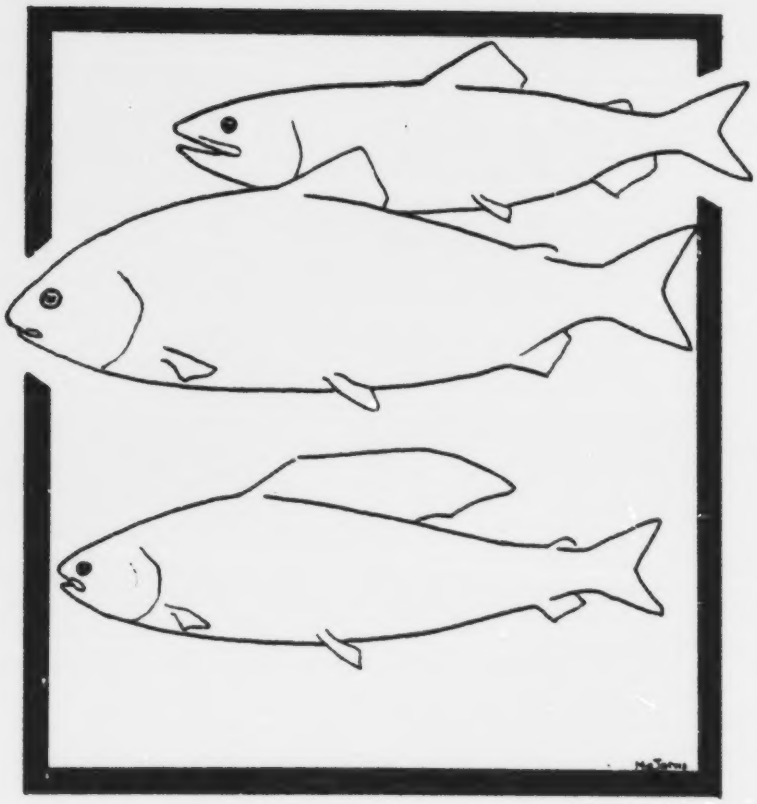
An Assessment of the Fisheries Resource in 18 Lakes within the Yukon Territory, Canada



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December 1983

YUKON RIVER BASIN STUDY
PROJECT REPORT: FISHERIES NO. 4

AN ASSESSMENT OF THE FISHERIES RESOURCE IN 18 LAKES WITHIN THE YUKON TERRITORY, CANADA.

by

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December 1983

DEPARTMENT OF FISHERIES AND OCEANS

WHITEHORSE, YUKON

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SUMMARY

The recognition of an escalation in sport fish harvest within lakes of the Yukon Territory prompted the Dept. of Fisheries and Oceans to initiate a number of assessment programs. On establishing a method for estimating acceptable yield levels using the morphoedaphic index the sequential objective became the expansion of understanding related to the biology and structure of northern fish populations.

A total of 18 lakes was chosen for this study, 16 of which occur within the Yukon River Basin. These included Alligator, Big Kalzas, Claire, Coghlan, Ethel, Fox, Jojo, Little Atlin, Little Salmon, Mayo, Michie, Quiet, Snafu, Taye, Twin and Wolf. The remaining two, Sekulmun and Dezadeash Lakes are within the Alsek River drainage system.

Field studies began during the summer of 1982 and continued through the winter and summer of 1983. The netting programs recorded a total of ten species with whitefish spp and lake trout comprising the major portion of the overall catch both by number and by weight. For example, the overall catch by weight consisted of 41.4% whitefish spp and 36.2% lake trout. Notably different catch per unit effort values were apparent between summer and winter seasons and among the different mesh sizes utilized. All catches were devoid of juvenile lake trout less than four years of age. Additions to previously compiled lists of species present were made to four lakes. Lake trout, northern pike, humpback and round whitefish displayed the widest distribution each appearing in at least 12 of the 18 lakes examined. Generally, most lakes were similar in terms of species diversity, however, Taye Lake yielded samples of only one species, northern

pike.

Biological information related to size, condition, age, sex composition, maturity and growth was compiled for each population by lake and by species. The potential of certain lakes to support faster growing fish was assessed and confirmed for some species. Rates of growth were compared between lakes and ranked accordingly. Age at maturity was also determined and the general trends in Yukon populations were recognized. The majority of lake trout were found to mature by their eleventh year which is several years later than in the populations of southern Canada. In terms of growth, Yukon lake trout also appeared to be much slower growing than most southerly populations. However, growth rates similar to those of southern populations were implied for humpback whitefish.

A management strategy for Yukon lakes is proposed in which previously compiled fish yield estimates are combined with species composition data collected in this study. This allows the formulation of guideline harvest levels for the primary target species in individual lakes. A method for developing interim harvest levels for lakes lacking all required information is also presented. Lake trout management is assigned priority due to the apparent vulnerability of this species to overfishing. Given the low levels of fish production in Yukon lakes, the importance of catch monitoring is emphasized along with the initiation of public education programs.

Recommendations for further investigations include: life history studies particularly for lake trout; further qualification of fish yield estimators; continuation of lake inventory programs to broaden species composition information; implementation of new catch monitoring techniques; and, the development of individual lake management strate-

gies. Any enhancement of native fish species is not recommended without a better understanding of life history and survival rates.

TABLE OF CONTENTS

		Page
Summary		I
List of Tables		V
List of Figures		VIII
List of Plates		XII
1. INTRODUCTION		1
2. STUDY AREAS		9
3. METHODS		29
3.1 Fish Capture Techniques		
	3.1.1 Gill nets	29
	3.1.1.1	29
	3.1.1.2	30
	3.1.2 Seine nets	30
3.2 Sampling Techniques		
	3.2.1 Measurements	30
	3.2.2 Ageing	32
	3.2.3 Sex and maturity	32
	3.2.4 Fecundity	33
3.3 Statistical Analyses		
	3.3.1 Catch per unit effort	33
	3.3.2 Net selectivity	33
	3.3.3 Condition	36
	3.3.4 Sex and maturity	36
	3.3.5 Growth rates	36
4. RESULTS AND DISCUSSION		39
4.1 Species diversity and distribution		39
4.2 Catch analysis		44
4.3 Catch per unit effort		54
4.4 Net selectivity		57
4.5 Mean size and condition		62
4.6 Sex composition and maturity		69
4.7 Fecundity		78
4.8 Growth rates		83
5. CONCLUSIONS AND RECOMMENDATIONS		117
Acknowledgements		121
Literature cited		123
Appendix A		129
Appendix B		133
Appendix C		135
Appendix D		145
Appendix E		159

LIST OF TABLES

Table		Page
1	Common and scientific names of non-anadromous species found within the area of study.....	2
2	Summary of sport fish licence sales: 1960 to 1982....	5
3	Summary of commercial and domestic lake trout and whitefish catches by weight: 1972-82.....	7
4	Lakes investigated during current study.....	11
5	Morphological characteristics of Yukon lakes included in study.....	13
6	Summary of the Morphoedaphic Index (MEI) and yield estimates for lakes included in study.....	15
7	Checklist of species recorded during the 1982/83 summer and winter lake investigations.....	40
8	Summary of catch composition; summer programs,1982/83	46
9	Summary of catch composition; winter program, 1983...	49
10	Summary of beach seine contents; summer, 1982.....	52
11	Catch per Unit Effort - all nets.....	55
12	Catch by number and by weight for all species caught in the floating gillnets.....	58
13	Catch by number and by weight for all species caught in the sinking gillnets.....	58
14	Catch by number and by weight for all species caught in floating and sinking gill nets combined.....	59
15	Average length, weight, K and age of the lake trout catch, including growth equations.....	63

Table		Page
16	Average length, weight, K and age of the least cisco catch, including growth equations.....	63
17	Average length, weight, K and age of the broad whitefish catch, including growth equations.....	63
18	Average length, weight, K and age of the northern pike catch, including growth equations.....	65
19	Average length, weight, K and age of the Arctic grayling catch, including growth equations.....	65
20	Average length, weight, K and age of the burbot catch, including growth equations.....	65
21	Average length, weight, K and age of the humpback whitefish catch, including growth equations.....	67
22	Average length, weight, K and age of the round whitefish catch, including growth equations.....	67
23	Average length, weight, K and age of the longnose sucker catch, including growth equations.....	67
24	Sex ratios of the lake trout catch.....	70
25	Sex ratios of the Arctic grayling catch.....	70
26	Sex ratios of the round whitefish catch.....	71
27	Sex ratios of the burbot catch.....	71
28	Sex ratios of the least cisco catch.....	71
29	Sex ratios of the northern pike catch.....	72
30	Sex ratios of the humpback whitefish catch.....	72

Table		Page
31	Proportional representation of maturation stages in lake trout	74
32	Proportional representation of maturation stages in humpback whitefish	76
33	Proportional representation of maturation stages in least cisco	76
34	Proportional representation of maturation stages in Arctic grayling	77
35	Proportional representation of maturation stages in round whitefish	77
36	Lake trout fecundity	80
37	Summary of Walford Equations and Brody Coefficients	97
38	Rank order of lakes according to the Brody Growth Coefficient for weight	111
39	Rank order of lakes according to the Brody Growth Coefficient for length	111
40	Age specific rankings based on mean weights within each age class, by species	112
41	Comparisons of overall growth rates (by weight) for species indicated	114
42	Suggested guideline harvest for lake trout, northern pike, and Arctic grayling in sixteen Yukon lakes based on total yield estimates and current composition data	119

LIST OF FIGURES

Figure		Page
1	Geographic distribution of lakes included in the current study.....	10
2	Preferred areas for the removal of scales for ageing.....	34
3	A comparison of fecundity: size relationships in lake trout from Alligator, Claire and Jojo Lakes.....	79
4	Average growth rates of lake trout from: A) Big Kalzas Lake; and, B) Jojo Lake; showing 95% confidence intervals and sample sizes.....	84
5	Average growth rates of lake trout from: A) Quiet Lake; and, B) Ethel Lake; showing 95% confidence intervals and sample sizes.....	84
6	Average growth rates of lake trout from: A) Fox Lake and, B) Coghlan Lake; showing 95% confidence intervals and sample sizes.....	85
7	Average growth rates of lake trout from: A) Twin Lake showing 95% confidence intervals and sample sizes.	85
8	Average growth rates of lake trout from: A) Claire Lake and, B) Alligator Lake; showing 95% confidence intervals and sample sizes.....	86
9	Average growth rates of least cisco from: A) Twin Lake; and, B) Quiet Lake; showing 95% confidence intervals and sample sizes.....	86
10	Average growth rates of northern pike from A) Snafu Lake showing 95% confidence intervals and sample sizes.....	87

Figure		Page
11	Average growth rates of northern pike from: A) Twin Lake; and, B) Taye Lake; showing 95% confidence intervals and sample sizes.....	87
12	Average growth rates of Arctic grayling from A) Claire Lake; and, B) Alligator Lake; showing 95% confidence intervals and sample sizes.....	88
13	Average growth rates of Arctic grayling from: A) Quiet Lake; and, B) Ethel Lake, showing 95% confidence intervals and sample sizes.....	88
14	Average growth rates of Arctic grayling from: A) Jojo Lake; and, B) Wolf Lake; showing 95% confidence intervals and sample sizes.....	89
15	Average growth rates of Arctic grayling from: A) Fox Lake showing 95% confidence intervals and sample sizes.....	89
16	Average growth rates of humpback whitefish from: A) Mayo Lake; and, B) Wolf Lake; showing 95% confidence intervals and sample sizes.....	90
17	Average growth rates of humpback whitefish from: A) Ethel Lake; and, B) Fox Lake; showing 95% confidence intervals and sample sizes.....	90
18	Average growth rates of humpback whitefish from: A) Dezadeash Lake; and, B) Little Atlin Lake; showing 95% confidence intervals and sample sizes.....	91
19	Average growth rates of humpback whitefish from: A) Michie Lake; and, B) Twin Lake; showing 95% confidence intervals and sample sizes.....	91
20	Average growth rates of round whitefish from: A) Big Kalzas Lake; and, B) Little Salmon Lake; showing 95% confidence intervals and sample sizes.....	92

Figure | Page

21 Average growth rates of round whitefish from: A) Mayo Lake; and, B) Wolf Lake; showing 95% confidence intervals and sample sizes..... 92

22 Average growth rates of round whitefish from: A) Quiet Lake; and, B) Ethel Lake; showing 95% confidence intervals and sample sizes..... 93

23 Average growth rates of round whitefish from: A) Dezadeash Lake; and, B) Little Atlin Lake; showing 95% confidence intervals and sample sizes..... 93

24 Average growth rates of round whitefish from: A) Claire Lake; and, B) Fox Lake; showing 95% confidence intervals and sample sizes..... 94

25 Average growth rates of burbot from: A) Little Atlin Lake; and, B) Quiet Lake; showing 95% confidence intervals and sample sizes..... 95

26 Average growth rates of broad whitefish from: A) Snafu Lake showing 95% confidence intervals and sample sizes..... 95

27 Walford plots showing the weight relationship for lake trout in: A) Alligator Lake; and B) Claire Lake; C) Jojo Lake; D) Quiet Lake..... 100

28 Walford plots showing the length relationship for lake trout in: A) Alligator Lake; and, B) Claire Lake; C) Jojo Lake; D) Quiet Lake..... 100

29 Walford plots showing the weight relationship for northern pike in A) Taye Lake..... 101

30 Walford plots showing the length relationship for northern pike in A) Taye Lake..... 101

31 Walford plots showing the length relationship for Arctic grayling in: A) Alligator Lake; B) Claire Lake; C) Fox Lake; D) Jojo Lake..... 102

32 Walford plots showing the weight relationship for Arctic grayling in: A) Alligator Lake; B) Claire Lake; C) Fox Lake; D) Jojo Lake..... 102

Figure		Page
33	Walford plots showing the weight relationship for Arctic grayling in A) Wolf Lake.....	103
34	Walford plots showing the length relationship for Arctic grayling in A) Wolf Lake.....	103
35	Walford plots showing the weight relationship for humpback whitefish in: A) Snafu Lake; B) Twin Lake.....	104
36	Walford plots showing the length relationship for humpback whitefish in: A) Little Atlin Lake; B) Snafu Lake; C) Twin Lake.....	104
37	Walford plots showing the weight relationship for humpback whitefish in: A) Dezadeash Lake; B) Ethel Lake; C) Michie Lake; D) Quiet Lake.....	105
38	Walford plots showing the length relationship for humpback whitefish in: A) Michie Lake; B) Quiet Lake; C) Ethel Lake; D) Dezadeash Lake.....	105
39	Walford plots showing the weight relationship for round whitefish in: A) Big Kalzas Lake; B) Claire Lake; C) Ethel Lake; D) Fox Lake.....	106
40	Walford plots showing the length relationship for round whitefish in: A) Big Kalzas Lake; B) Claire Lake; C) Ethel Lake; D) Fox Lake.....	106
41	Walford plots showing the weight relationship for round whitefish in: A) Mayo Lake; B) Little Atlin Lake; C) Quiet Lake.....	107
42	Walford plots showing the length relationship for round whitefish in: A) Mayo Lake; B) Little Atlin Lake; C) Quiet Lake; D) Wolf Lake.....	107
43	Walford plots showing the weight relationship for least cisco in: A) Twin Lake; B) Quiet Lake....	108

LIST OF PLATES

Plate		page
1	Alligator Lake	17
2	Ethel Lake	17
3	Lake trout, Big Kalzas Lake	31
4	Winter netting program	31
5	Setting gill net, Alligator Lake	35
6	Winter netting program	35
7	Lake trout, Wolf Lake	41
8	Jojo Lake	41
9	Least cisco, large spotted variety, Quiet Lake	45
10	Arctic grayling, Quiet Lake	45

1. INTRODUCTION

Historical Perspective

The freshwater fishery of the Yukon has always formed an integral part of life in the Territory. Historically, the earliest use of the resource was by the indigenous people of the north who fished at a subsistence level as part of their traditional lifestyles. With the onset of the Klondike gold rush and its ensuing population influx, fishing became an invaluable means of providing nourishment for both man and dogs. Various commercial operations flourished and disappeared over the years, most of which were concentrated near population centres (Seigel in prep.). With this population influx, also came another breed of fisherman, the recreation or sport angler. However, it wasn't until the opening of the Alaska Highway in the early 1940's that sport fishing came into its own in the Territory. The new road provided access to numerous water bodies previously unexploited, an advantage which resulted in sport fishing becoming a prominent feature in both outdoor recreation and in the promotion of tourism (Sinclair and Sweitzer 1973).

Fisheries Resource

Within the portion of the Yukon encompassed by this study, the fisheries resource is composed of 21 species, 17 of which are non-anadomous (Table 1). In addition to these, at least two unique or hybrid species occur: the "tezra" or "jumbo" whitefish found in the Pelly-Tatlemain region;and,a large,spotted form of least cisco found in Quiet and Twin lakes. With regards to limited distribution, other species of note include:the pygmy whitefish, common to

Table 1 Common and scientific names of non-anadromous species found within the area of study.

Common Name	Scientific Name
lake trout	Salvelinus namaycush (Walbaum)
Dolly Varden	S. malma (Walbaum)
northern pike	Esox lucius (Linnaeus)
Arctic grayling	Thymallus arcticus (Pallas)
humpback (lake) whitefish	Coregonus clupeaformis (Mitchill)
broad whitefish	C. nasus (Pallas)
least cisco	C. sardinella (Valenciennes)
round whitefish	Prosopium cylindraceum (Pallas)
pygmy whitefish	P. coulteri (Eigenmann and Eigenmann)
burbot, lingcod	Lota lota (Linnaeus)
longnose sucker	Catostomus catostomus (Forster)
slimy sculpin	Cottus cognatus (Richardson)
lake chub	Couesius plumbeus (Agassiz)
inconnu	Stenodus leucichthys (Guldenstadt)
rainbow trout	Salmo gairdneri (Richardson)
Arctic lamprey	Lampetra japonica (Martens)
threespine stickleback	Gasterosteus aculeatus (Linnaeus)

Squanga Lake; the Dolly Varden char, which appears extremely limited to within the headwater regions of the east-central watershed; and, the rainbow trout which is believed to have appeared in the Yukon River drainage as a result of human introduction sometime prior to 1960.

Numerous attempts have been made to document fish species distribution within the Yukon River Basin (Slaney 1974; Evirocon 1980A; Envirocon 1980B; Canada Dept. of Fisheries and Oceans 1982) with the most recent being compiled by Ennis et al. (1982A). The distribution maps resulting fro this latter study illustrate the documented presence of fish species to a 1:250,000 scale assimilated from some 223 references. Generally, within stream habits grayling and whitefish species species appear to be most ubiquitous with salmon species following close behind. On the other hand, lake trout, whitefish spp, and pike are all widespread amongst the lake habitats. (Ennis et al 1982A).

Apart from the Fisheries Service catalogue series produced from 1973 to 1976 (Canada Dept. of Environment 1973; Elson 1974; Walker et al 1974; Brown et al 1976) and the recently-initiated Yukon Aquatic Inventories (Davies and Ellenton 1980; Davies and Shepard 1981; Davies and Osborne 1983; Pendray 1983), no systematic inventory of fisheries resources has been conducted at a level which provides extensive baseline data required for many of the decisions currently facing resource managers. Although considerable information does exist, as evidenced by a bibliography recently compiled by Ennis et al.(1982B) most of it has been collected in response to proposed habitat disruptions such as the construction of pipelines, roads, dams and mines. As a result,the scope of the knowledge related to dis-

tribution is somewhat limited to transportation and/or construction corridors or to site specific studies pertaining to other developments.

Current Resource Utilization

Current resource utilization of the fisheries resource falls into four categories: native food; sport; domestic;and, commercial fisheries.

Although primarily concentrating on salmon, the native food fishery continues to exploit freshwater species from a number of traditional sites throughout the Yukon. Exact details of this fishery are poorly documented; however, information forthcoming through the anticipated Land Claims settlement may help in obtaining a better understanding of the nature and extent of this fishery.

The most active and extensive user group currently present in the Yukon is composed of the sport fisherman. In a comprehensive review of the sport fishery,Paish (1981) noted a dramatic increase in total sport fishery licence sales from 8,504 in 1970 to 17,263 in 1980 (Table 2). Yet, during the same period, catch trends showed a decrease. Based upon questionnaire data,the estimated total harvests (excluding salmon) declined from about 231,000 fish in 1970 to 186,300 in 1975 (Paish, 1981). Unpublished data obtained from the 1980 National Sport Fishing Survey show a continued downward trend with an estimated total sport harvest of 156,200 fish (excluding salmon) for that year. Of note, however,is that during 1980 an estimated additional 136,500 fish were released. This leads to some confusion as to whether the apparent decline is real or represents a greater tendency towards a catch and release fishery.

Table 2. Summary of sport fishing licence sales 1960 to 1982.

YEAR	RESIDENT	NON-RES. FULL TERM	NON-RES. SHORT TERM	NON-RES. TOTAL	TOTAL LICENCE SALES
1960-61	2612	3721	-	3721	6333
1961-62	2600	3960	-	3960	6560
1962-63	2672	3687	-	3687	6359
1963-64	2857	4229	-	4229	7080
1964-65	2505	4185	-	4185	6690
1965-66	2543	5109	-	5109	7652
1966-67	2760	5916	-	5916	8676
1967-68	2679	6969	-	6969	9648
1968-69	2840	7483	-	7483	10,323
1969-70	2978	7513	-	7513	10,491
1970-71	4466	1386	2652	4038	8504
1971-72	5585	711	3853	4564	10,149
1972-73	5104	785	3719	4504	9608
1973-74	6629	1039	4232	5271	11,900
1974-75	7783	835	3245	4080	11,863
1975-76	8578	1088	3549	4637	13,215
1976-77	8836	869	3220	4089	12,925
1977-78	9642	1105	3865	4970	14,612
1978-79	10,401	1351	3969	5320	15,721
1979-80	10,987	2343	3503	5846	16,835
1980-81	11,892	1911	3460	5371	17,263
1981-82	11,867	1910	3574	5484	17,351
1982-83	9898	1384	2380	3764	13,662

Note: Resident = resident of Canada
Non-Resident SHORT TERM = 1 or 5 day licences

Primary target species in the sport fishery are Arctic grayling, lake trout and northern pike, which make up approximately 50%, 30% and 15% respectively of the total catch numbers. The greatest contributor by far in terms of weight is lake trout which comprise 80% of the catch whereas grayling and pike total only 10% and 7% respectively (Paish 1981).

The issuance of commercial and domestic netting licenses is currently restricted to 20 designated lakes (Canada, Dept. of Fisheries and Oceans 1983). A summary of the number of licences issued and estimated catches of lake trout and whitefish spp from 1972 to 1983 (Table 3) indicates an increased interest in both fisheries over the past decade. Licence sales jumped from less than 60 in the early 1970's to more than 150 in 1982 in each fishery. Dept. of Fisheries and Oceans' catch records, derived by a voluntary reporting system, indicate a relatively stable harvest averaging 4800 kg (approximately 3200 pieces) of lake trout and 5900 kg (approximately 5900 pieces) of whitefish annually. Of note is the recent increase in harvest during the 1982-83 season which resulted in catches of 5544 kg lake trout and 8633 kg whitefish (Table 3). Nevertheless these figures, even when combined, represent only a fraction of the total harvest by anglers estimated in 1980 to approximate 200,000 kg (Canada, Dept. of Fisheries and Oceans in prep. A).

Management Objectives

In 1981, the Dept. of Fisheries and Oceans in Whitehorse initiated a program in an attempt to predict acceptable harvest levels for individual lakes. This was prompted by a recognition of the increasing pressure being exerted on the fishery resource which

Table 3 Summary of commercial and domestic lake trout and whitefish catches by weight, 1972-82.

	LICENCES ISSUED		LAKE TROUT (KG)			WHITEFISH (KG)			TOTAL CATCH (KG)		
YEAR	COMMERCIAL	DOMESTIC	COMMERCIAL	DOMESTIC	TOTAL	COMMERCIAL	DOMESTIC	TOTAL	COMMERCIAL	DOMESTIC	TOTAL
1972-73	56	*	3897	*	3897	3914	*	3914	7811	*	7811
1973-74	81	*	4550	*	4550	5978	*	5978	10,528	*	10,528
1974-75	74	42	4048	175	4223	5372	1419	6791	9420	1594	11,014
1975-76	88	69	3749	232	3981	3658	1322	4980	7407	1554	8961
1976-77	81	71	4197	176	4373	3501	1677	5178	7698	1853	9551
1977-78	86	75	4138	413	4551	4407	1651	6058	8545	2064	10,609
1978-79	90	116	2015	964	2979	4304	1689	5993	6315	2653	8968
1979-80	108	95	3503	180	3683	6012	577	6589	9515	757	10,272
1980-81	119	93	2774	42	2816	4570	861	5431	7344	903	8247
1981-82	132	166	3454	470	3924	3870	1397	5267	7324	1867	9191
1982-83	156	159	5102	442	5544	6849	1784	8633	11,951	2226	14,177
Mean	97	98**	3766	344**	4815	4767	1375**	5892	8533	1719**	9939

* domestic permits not issued prior to 1974-75 season
** 9 yr. average

NOTE - Approximate catches in numbers of fish can be derived by dividing the lake trout and whitefish catches by 1.5 kg and 1 kg respectively which represent the average weights of these species.

Whitefish : primarily humpback whitefish with small incidental catches of broad and round whitefish.

was brought to light by Paish (1981) and the findings of the 1975 and 1980 sport fishing surveys (Canada, Dept. of Fisheries and Oceans 1978 and in prep. A). An upsurge in the commercial sport fishing industry added to the potential of increased activity. At the same time, the level of information on the status of the resource was considered inadequate in order to responsibly assess the potential impact of existing and future exploitation.

Sixty-seven lakes were selected for the study based on their existing utilization. The necessary information was compiled to estimate yields using the morphoedaphic index (MEI) (Ryder 1965).

Although the study provided invaluable information on the previously unassessed levels of fish production, it fell short of supplying a means for partitioning these yields by individual species (Horler in prep.). As this partitioning is necessary for any steps to be taken towards resource allocation, further insight into species presence and abundance became the next step towards the development of an overall Yukon lake management program.

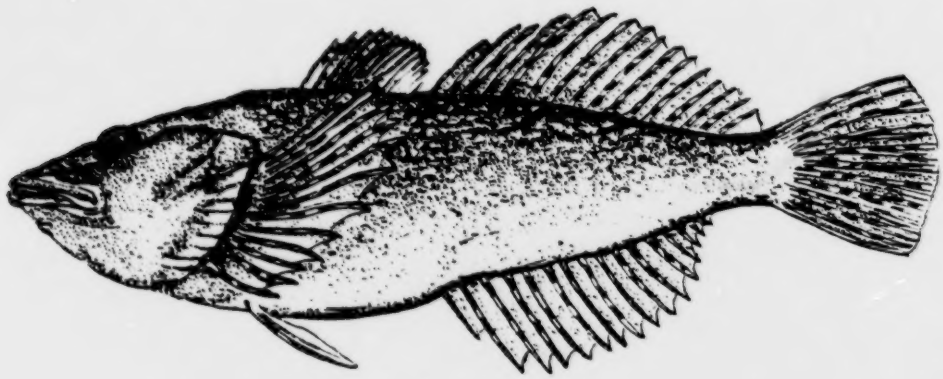
In recognition of this need the objectives of the current study were detailed as follows:

1. to determine the composition of fish species within a representative portion of the lakes for which harvestable yield estimates had been previously determined;

2. to collect baseline biological data of harvestable species pertaining to size, age, growth, maturity and condition factors;

3. to assimilate the estimated fish yield and obtained species composition data for the development of a method by which to determine allowable harvest limits for target species within Yukon lakes.

This report presents the results of an inventory of fish resources within 18 lakes of the Yukon Territory conducted in order to further the understanding of the basic biology, structure and management requirements of Yukon fish populations.



SLIMY SCULPIN *Cottus cognatus*

2. STUDY AREAS

A total of 18 lakes in the Yukon was selected for study (Table 4). Two of these lie within the Alsek River drainage while the remainder are located within the Yukon River basin. Criteria for selection were based largely on estimated productivity levels (Horler in prep.) and known fish resource utilization. A wide spectrum of lakes was required to ensure adequate representation of the region's diversity.

The following is a summary of each lake investigated. The morphological characteristics of each of these lakes are found in Table 2.

Alligator Lake is situated approximately 40 km southwest of Whitehorse in the Boundary Range within the Coast Mountains ecoregion of the Yukon Territory. The lake drains to the east into the Yukon River

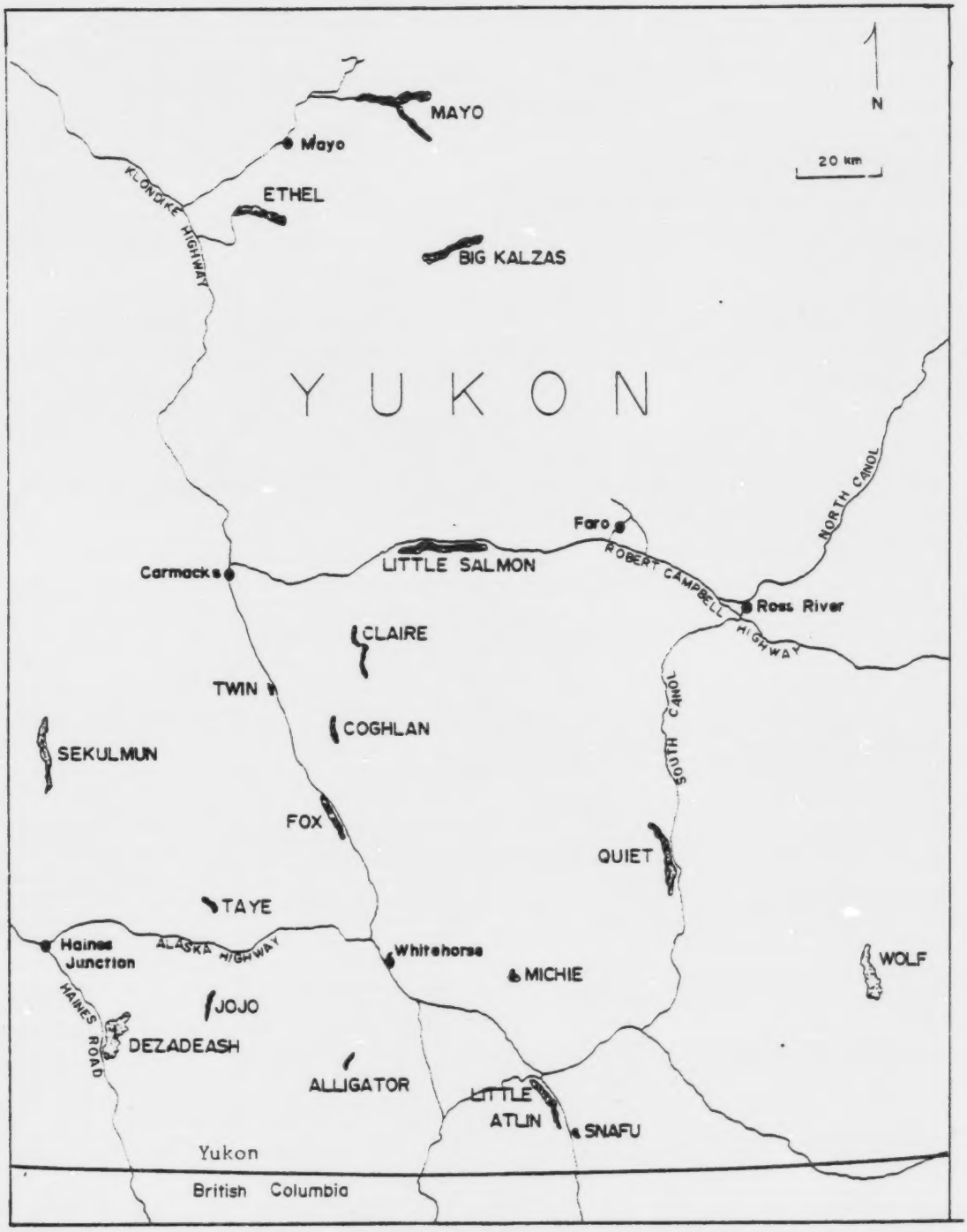


Fig 1 Geographic distribution of lakes included in the current study.

TABLE 4. Lakes investigated during the current study.

LAKE	LOCATION LAT.	LOCATION LONG.	DRAINAGE	ELEVATION (m)	ROAD ACCESS
Alligator	60° 23'	135° 21'	Yukon	1,128	Seasonal
Big Kalzas	63° 15'	134° 35'	Yukon-Pelly	788	No
Claire	61° 53'	135° 19'	Yukon	701	No
Coghlan	61° 33'	135° 29'	Yukon	732	No
Dezadeash	60° 28'	136° 58'	Alsek	701	Yes
Ethel	63° 22'	136° 06'	Yukon-Stewart	764	Seasonal
Fox	61° 14'	135° 28'	Yukon	765	Yes
Jojo	60° 34'	136° 21'	Yukon-Takhini	889	No
Little Atlin	60° 15'	133° 57'	Yukon	687	Yes
Little Salmon	62° 11'	134° 40'	Yukon	609	Yes
Mayo	63° 43'	135° 04'	Yukon-Stewart	670	Yes
Michie	60° 41'	134° 10'	Yukon	742	No
Quiet	61° 05'	133° 05'	Yukon-Teslin	853	Seasonal
Sekulmun	61° 26'	137° 33'	Alsek	914	Seasonal
Snafu	60° 11'	133° 26'	Yukon	731	Seasonal
Taye	60° 56'	136° 21'	Yukon-Takhini	701	Seasonal
Twin (West)	61° 42'	135° 59'	Yukon-Nordenskiold	609	Yes
Wolf	60° 39'	131° 40'	Yukon-Teslin	991	No

via the Watson River.

Bedrock is intrusive, with granite and quartz varieties dominating. Morainal and glaciofluvial material is present from glaciation. Soil textures are variable, with most being coarse (Oswald and Senyk 1977). The lake shoreline is fairly steep, with rocky beaches and little sand.

Vegetation surrounding the lake is dominated by white spruce, with understory being willow and low berry bushes.

Average annual temperature in the region is -1° C, and average annual precipitation is 226 mm (Canada, Dept. of Environment 1982).

Current fishing activity is restricted by the limited access. The lake may be reached by air or by a trail (4 wheel drive when conditions are suitable) approximately 20 km west of the Annie Lake Rd. Although the area is popular during the hunting season, there is believed to be light fishing pressure and perhaps less than in the past.

Big Kalzas Lake lies within the Pelly River ecoregion of the Yukon. The lake drains to the southwest via the Kalzas River into the MacMillan River and on into the Pelly River. It is surrounded by the Clarke Hills with the 1,920 m peak of Kalzas Mountain being the dominant feature of the landscape.

Large bodies of volcanic and intrusive rocks, and smaller bodies of sedimentary rocks occur throughout the area, although the major part is underlain by metamorphic rock (Oswald and Senyk 1977).

White and black spruce are the most common forest types with the understory being comprised of feathermoss and willows.

The littoral zone of the lake is composed mainly of small rocks

TABLE 5 Morphological characteristics of Yukon lakes included in study(from Horler and Jarvis in preparation, A).

LAKE	AREA (ha)	VOLUME ($m^3 x 10^6$)	LENGTH ($m x 10^3$)	MAX WIDTH ($m x 10^3$)	MEAN WIDTH ($m x 10^3$)	MEAN DEPTH (m)	MAX DEPTH (m)	SHORELINE (m)
Alligator	629	34.1	5.5	1.9	0.97	5.4	10	15,227
Big Kalzas	4,220	27.3	24.4	2.4	0.17	64.6	135	60,412
Claire	2,034	1021.8	12.9	1.7	1.26	52.9	104	57,771
Coghlan	823	196.1	11.4	1.2	0.72	23.8	58	33,251
Dezadeash	8,250	336.6	20.5	9.2	0.40	4.1	6	69,402
Ethel	4,730	1462.7	20.4	3.2	2.30	30.9	62	50,089
Fox	1,660	474.4	18.3	1.4	0.91	28.6	47	38,817
Jojo	639	195.8	11.2	0.9	0.57	30.6	63	25,071
Little Atlin	3,790	401.7	21.0	3.2	1.80	10.6	47	54,217
Little Salmon	6,210	5752.0	32.7	2.8	1.90	92.6	155	79,218
Mayo	9,000	5084.4	31.4	3.5	2.57	56.5	106	116,679
Michie	388	57.7	4.3	1.8	0.90	14.9	43	19,971
Quiet	3,780	1245.0	12.3	1.8	0.31	32.9	170	36,060
Sekulmun	5,610	1536.7	28.9	2.9	1.94	27.4	47	67,210
Snafu	300	18.9	6.7	1.6	0.45	6.3	25	33,149
Taye	843	20.6	8.2	1.7	0.10	2.4	4	22,325
Twin	160	25.8	2.4	1.6	0.67	16.2	43	11,237
Wolf	7,350	1955.6	20.8	5.8	3.50	26.6	72	57,400

and pebbles with many beach areas and extended shoals.

The average annual temperature is -5°C, and the average annual percipitation is 300 mm (Canada, Dept. of Environment 1982).

Big Kalzas Lake is accessible by air only, lying 196 km north of Whitehorse and 80 km southeast of Mayo. The relative inaccessibility is probably largely responsible for the current low fishing pressure by resident Yukon anglers, although past and present interest in establishing a fly-in sport fishing facility have prompted predictions of increasing activity in the future.

A commercial net fishing quota was established on the lake in 1961. Although still in effect, there has been very little commercial fishing activity on this lake for a number of years.

Claire Lake is within the Lake Laberge ecoregion of the Yukon Territory. The lake drains north into the Yukon River via Claire Creek.

The bedrock is sedimentary and is composed mainly of limestone, sandstone, siltstone and conglomerate. Glaciation left extensive deposits of glacial drift, consisting of morainal and glaciofluvial material interspersed with pond sediments (Oswald and Senyk 1977).

Vegetation surrounding the lake is predominantly white spruce, with alder and willow growing extensively along the shoreline. The undergrowth consists mainly of feathermoss and a wide variety of shrubs and herbs.

The average annual temperature is -5°C and the average annual precipitation is 247 mm (Canada, Dept. of Environment 1982).

Although only accessible by air (approximately 131 km NNW of Whitehorse), Claire Lake has become a popular fishing area for many

TABLE 6. Summary of the Morphoedaphic Index (MEI) and Yield estimates for lakes included in study (from Horler in preparation).

LAKE	MEI (Metric)	ESTIMATED POTENTIAL ANNUAL YIELD OF FISH (all spp) (kg/ha)	ESTIMATED TOTAL POTENTIAL ANNUAL YIELD OF FISH (all spp) (kg)
Alligator	5.72	3.01	1,893
Big Kalzas	0.85	1.29	5,444
Claire	2.89	2.22	4,529
Coghlan	12.80	4.32	3,555
Dezadeash	14.20	4.52	37,290
Ethel	2.65	2.14	10,122
Fox	7.45	3.39	5,627
Jojo	1.01	1.39	888
Little Atlin	15.20	4.66	17,661
Little Salmon	1.22	1.51	9,377
Mayo	1.66	1.74	15,660
Michie	9.40	3.77	1,463
Quiet	2.19	1.96	7,409
Sekulmun	3.14	2.31	12,959
Snafu	25.20	5.84	1,752
Taye	37.10	6.93	5,842
Twin	13.50	4.42	707
Wolf	1.99	1.88	13,818

Yukon residents in search of large northern pike and lake trout. Fishing pressure is currently considered to be low to moderate, although recent interest in establishing a fly-in fishing facility has created the potential for an increase in activity.

Coghlan Lake like Claire, lies within the Lake Laberge ecoregion of the Yukon. The lake drains north and northeast via Frank Creek and Lake to the Yukon River.

The geology, vegetation and weather information are similar to that described for Claire Lake.

Coghlan lake is accessible by air, lying 124 km from Whitehorse. Lake residents and fly-in fishermen currently exert a moderate amount of pressure on the fish stocks with an increase anticipated as a result of accelerated interest in establishing a sport fishing camp.

Dezadeash Lake lies within the Shakwak Valley, in the Coast Mountain ecoregion of the Yukon. The lake drains via Six Mile Lake into the Dezadeash River which, in turn, flows south into the Alsek River and the Pacific Ocean.

Bedrock is mostly metamorphic consisting of schist, gneiss, quartzite, quartz, mica schist and slate (Oswald and Senyk 1977). The valley is mantled with deep morainal and glaciofluvial materials resulting in course-textured soils.

Nearly closed stands of white spruce mixed with balsam, poplar and willow predominate the lake shore. Moss, herbs and shrubs occupy the understory.

The average annual temperature is -3°C, and the mean annual precipitation is 723 mm (Canada, Dept. of Environment 1982).

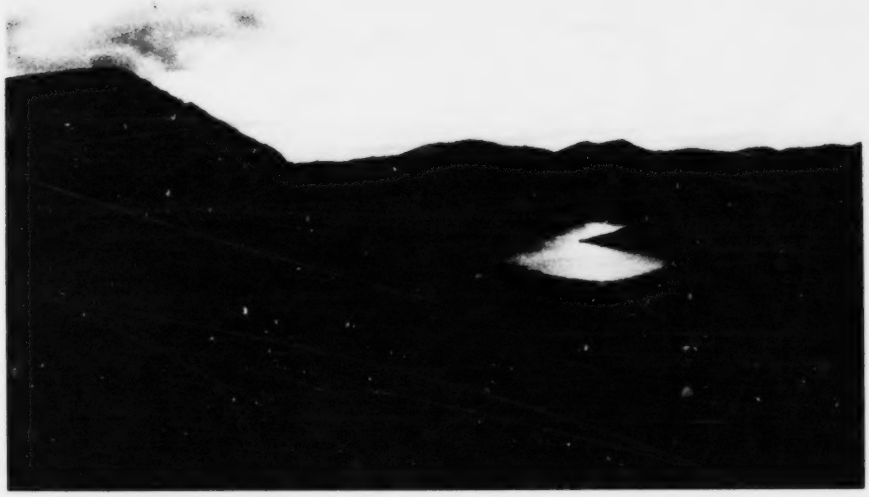


Plate 1. Alligator Lake.

Plate 2. Ethel Lake.

Dezadeash Lake has been a popular area for a number of years. Easy access, good service facilities and local boat rentals (with guide) have combined to create a moderate to heavy fishing pressure, especially the lake trout population. In 1961, a commercial net fishing quota was established for lake trout and whitefish but it was removed in 1964 due to conflicts with the recreational fishery. Although Dezadeash has the potential for increased exploitation by both tourists and residents, the lake is frequently extremely rough which keeps fishermen on shore for days at a time.

Ethel Lake lies within the Pelly River ecoregion, just east of the Tintina Trench. The lake drains northeast via Ethel Creek to Nogold Creek and into the Stewart River.

Bedrock material is mostly metamorphic. The area was not heavily glaciated during the last ice advance; fine-texured glaciolacustrine deposits occur throughout (Oswald and Senyk 1977). The shoreline is composed mostly of gravel and rock. The topography on the north shore of the lake is mountainous, while the other shores are backed by rolling hills.

Vegetation grows right to the lake shore and consists mainly of white and black spruce. The understory vegetation is dominated by mosses and open-growth willows.

Average annual temperatures in the area is -4°C and average annual precipitation is 293 mm (Canada, Dept. of Environment 1982).

Ethel Lake is accessible during the summer by a 35 km road running north-east of the Klondike Highway, 24 kilometres south of Stewart Crossing. A Territorial campsite and a boat launch attract tourists and residents, creating a moderate amount of fishing activity.

Ethel Lake was open to commercial net fishing from 1961 until 1967 when it was closed to minimize user conflicts. No significant increase in fishing pressure is anticipated in the near future due to limitations imposed by the facilities and location.

Fox Lake lies within the Lake Laberge ecoregion of the Yukon Territory. Bounded by rolling hills, the lake drains south via Richthofen Creek into Lake Laberge and the Yukon River.

The bedrock is mainly sedimentary, with old lake deposits combining with limestone, sandstone and siltstone. Glacial drift covers lower elevations above proglacial lake deposits. Soil composition is variable due to heterogeneity of deposits (Oswald and Senyk 1977).

Spruce forest surrounds the lake in an open-growth pattern, accompanied by lodgepole pine. Feathermoss and low shrubs fill the understory. The lake shore rises fairly steeply to the west into the low Miner Hills, while the east side is bounded by low ridges.

Average annual temperature in the area is -5°C, and the average annual precipitation is 247 mm (Canada, Dept. of Environment 1982).

The Klondike Highway provides easy access to this lake, 47 km north of Whitehorse. Fishing activity is exerted mainly by tourists (fishing from shore), local cottage owners and Whitehorse residents. Although Fox Lake once had a reputation as a good fishing lake, success has become so limited that the number of Yukon anglers has decreased (D'Estimauville 1981; Horler and Jarvis in prep.).

Fox Lake was designated for the commercial fishing of whitefish and lake trout from 1961 until 1964, when it was closed due to the poor quality of fish. Many local residents maintain that the netting

activity during this time was responsible for the decline of the lake trout population.

Fishing pressure on this lake is expected to remain low as current angler success will do little to promote an increase in activity.

Jojo Lake is located in the Coast Mountains ecoregion of the Yukon Territory. Surrounded by the Coast Mountain Range, the lake drains south into Kusawa Lake and the Takhini River to the Yukon River.

The bedrock material is intrusive, mainly composed of granite and quartz varieties. Soil textures are variable. Morainal material derived from intrusive bedrock is medium-to-coarse textured. Much of the higher elevation area has little till left (Oswald and Senyk 1977).

Shrub birch and willow cover the sub-alpine slopes of the lake shore, with open-growth white spruce growning near the water. Mosses, herbs and low shrubs form the understory. The lake rests in a narrow mountain valley bounded by steeply rising slopes.

Average annual temperature for the area is -3°C, with the average annual precipitation being 281 mm (Canada, Dept. of Environment 1982).

Located 72 km SW of Whitehorse Jojo Lake is only accessible by air, a fact which restricts the number of potential anglers. It receives moderate fishing activity as it is popular with residents and is used by several commercial sport fishing ventures as a site for one-day excursions. Although there are currently no facilities available to fly-in fishermen, interest has been expressed in establishing a facility which would thereby increase the fishing activity.

Little Atlin Lake lies within the Lake Laberge ecoregion of the Yukon Territory. This shallow lake is bounded by low hills on both sides. Drainage is through the Lubbock River into Atlin Lake, and then the Atlin River to Tagish Lake and the Yukon River.

Bedrock geology is mostly sedimentary limestone, sandstone and siltstone. Glacial drift and proglacial lake deposits cover low elevation sites. Glaciolacustrine soils are silty and sandy (Oswald and Senyk 1977).

Open-growth white spruce is dominant in older stands, but fires have created many burn sites which are vegetated by lodgepole pine. Aspen and poplar are also common, while the understory along the lake is mostly moss and low shrubs.

Average annual precipitation is 226 mm, while the average annual temperature is -1°C (Canada, Dept. of Environment 1982).

Access to Little Atlin Lake is from the Atlin Road approximately 133 km from Whitehorse. Popular with residents, especially right after break-up, this lake receives moderate to high fishing pressure which can be periodically restricted by rough water conditions. Lack of an adjacent campsite limits tourist activity.

Like Fox Lake, Little Atlin Lake was open for commercial whitefish and trout fishing from 1961 to 1964 when it was closed due to poor quality fish resulting from parasite infestation. Improved facilities could increase future harvest levels, although none are currently anticipated.

Little Salmon Lake lies within the Lake Laberge ecoregion of the Yukon Territory. The lake sits in the northerly reaches of the Pelly Mountains and drains via Little Salmon River into the Yukon River.

Bedrock geology is sedimentary, interspersed with some intrusive material. Upper elevation areas have shallow moraine deposits and bedrock outcroppings (Oswald and Senyk 1977). The lake has steep rocky shorelines with a rocky littoral zone, and few sandy shoreline sections.

White and black spruce grow to the edge of the lake, with alpine fir on the higher slopes. Feathermoss and low shrubs occupy the understory.

The average annual temperature for the area is -5° C, while the average annual precipitation is 247 mm (Canada, Dept. of Environment 1982).

Little Salmon Lake became accessible by road with the opening of the Robert Campbell Highway in 1968. Two territorial campsites and a lodge provide several facilities for fishermen. Local lake residents blame the reduction in lake trout numbers on the commercial fishery which existed from 1961 until 1970, although there is no concrete evidence that this was the case. Although the site of moderate fishing activity by locals and an annual fishing derby, the success rate is so low that the harvest is considered to be minimal, when compared with other large lakes. Fishing activity may increase in time, although there is presently no indication of an upward trend.

Mayo Lake lies within the Mayo Lake-Ross River ecosystem of the Yukon. The lake drains west and south via the Mayo River into the Stewart River.

Most of the terrain is underlain by metamorphosed sedimentary and volcanic rock, with granite intrusions occuring frequently. Large deposits of silts occur in the area (Oswald and Senyk 1977).

The average annual temperature is -4°C, and the average annual precipitation is 495 mm (Canada, Dept. of Environment 1982).

Mayo Lake is situated 54 km from the town of Mayo and can be reached via dirt road. However, the lack of a campsite and a good boat ramp have not encouraged tourists and residents to make use of the lake, which currently receives low to moderate pressure. In addition, extensive placer mining activities in the area may deter those looking for a wilderness fishing experience.

A power dam constructed by Northern Canada Power Commission in 1954 raised the level of the lake by as much as 4 m creating as yet undocumented effects on the fish populations.

Although Mayo Lake has been designated for commercial fishing since 1961, little netting activity has taken place for a number of years. No increase in either sport or commmercial fishing is anticipated in the next few years.

Michie Lake lies within the Lake Laberge ecoregion of the Yukon Territory. The lake is drained by Michie Creek and the McClintock River to Marsh Lake and the upper Yukon River. This shallow lake is bounded by gently sloping mountains.

The bedrock geology of the area is sedimentary, consisting mainly of limestone, sandstone and siltstone. The low valleys were glaciated and contain glacial drift deposits mixed with glaciolacustrine lake deposits. Soils are silty and sandy with mixed gravels (Oswald and Senyk 1977).

Open white spruce growth cover the valley sides along the lake, while black spruce occupies the wetter areas. The shallow sections of the lake tend to be marshy. Feathermoss and low shrubs form the under-

story vegetation.

Average annual temperature of the area is -1°C, and average annual precipitation is 260 mm (Canada, Dept. of Environment 1982).

Michie Lake is accessible either by air (lying approximately 40 km north-east of Whitehorse) or by a rough 4-wheel drive track. Fishing pressure has been moderate for a number of years and no significant increase can be foreseen due to the limited accessibility.

Quiet Lake lies within the Pelly Mountains ecoregion of the Yukon and is bordered on the east by the Salmon Range and on the west by the Pelly Mountains. It drains northwest to the Yukon River through Big Salmon Lake and River.

Bedrock geology consists largely of intrusive rock such as granite, granodiorite, diorite and monzonite, but also contains metamorphosed sedimentary and volcanic rocks. The valley bottom is generally mantled with glaciofluvial and morainal materials (Oswald and Senyk 1977).

Open-growth black and white spruce dominate the lake shore, although lodgepole pine is common in burn areas. Much of the littoral zone is composed of rocks and pebbles with some beaches and shoals.

The mean annual temperature is -2°C, and the mean annual precipitation is 812 mm (Canada, Dept. of Environment 1982).

Quiet Lake can be reached via the South Canol Highway during the summer months only. A Territorial campsite is located 100 km north from Johnson's Crossing and 124 km south of Ross River. Fishing pressure by both sport and commercial fishermen is considered to be low.

Sekulmun Lake lying within the Ruby Range ecosystem of the Yukon, is bounded by the Ruby Range on the west and to the east by Aishihik Lake. The lake drains into the Alsek River through the Aishihik lake and river system.

Intrusive material forms the main part of the bedrock, comprised of granite and quartz varieties (Oswald and Senyk 1977).

White and black spruce are common, with a scattered presence of paper birch, aspen and poplar. The understory generally consists of willow, scrub birch and alder. Boulders occur frequently along the lake shore, with few beach areas.

The average annual temperature is -4.7°C, and the precipitation is 966 mm (Canada, Dept. of Environment 1982).

Sekulmun Lake can be reached either by a 70 km rough dirt road which follows Aishihik Lake, or by boating up Aishihik Lake and the Link River. In spite of its difficult access, Sekulmun's growing reputation as a trophy lake has subjected it to a moderate amount of fishing pressure. Commercial fishing was permitted from 1961 until 1968, at which time it was closed due to the escalation of recreational fishing. While deteriorating road conditions have had a tendancy to inhibit many potential anglers, the lake's attractive prospects will likely ensure a continuation of present fishing levels.

Snafu Lake is in the Lake Laberge ecoregion of the Yukon. Set in low rolling hills, the lake drains through Snafu Creek and the Lubbock River into Atlin Lake and hence into the Yukon River.

Bedrock geology in the area is sedimentary and is covered with proglacial lake deposits. Soil consists of fine-textured silt and sand. The lake bed is shallow with many shoals and small islands. Lake shore

topography is gentle, giving way to low hills (Oswald and Senyk 1977). The lake is in the midst of a large forest burn, re-vegetated by lodgepole pine, aspen and poplar. Feathermoss is the dominant understory vegetation.

Average annual temperature for the area is -1°C, while the average precipitation annually is 226 mm (Canada, Dept. of Environment 1982).

Snafu Lake is located 155 km from Whitehorse, a few kilometres off the Atlin Road. The lake is popular with Yukon residents and receives a moderate level of fishing pressure. A Territorial campsite provides some facilities and the areas of unobstructed shoreline in its vicinity allow for good shore fishing. Its shape makes it one of the few lakes in the Territory popular with canoeists.

Taye Lake, like Sekulmun lake, is in the Ruby Range ecoregion of the Yukon Territory. This extremely shallow lake drains via the Mendenhall River into the Takhini River and hence to the Yukon River.

Granite and quartz intrusive material forms the main part of the bedrock. The wide valley in which the lake is set has post glacial deposits of silts, sand and clays. Surrounding the lake are low-lying hills resulting in gentle gradient to the shoreline (Oswald and Senyk, 1977).

Vegetation consists of sedge and grass meadows along the north shore side of the lake, whereas open growth white spruce predominates the south shore. Heavy underbrush of willow, berry bushes and alder is also present. This shallow lake has marshy areas at both ends.

Average annual precipitation is 281 mm and average annual temperature is -3°C. (Canada, Dept. of Environment, 1982).

Taye Lake can be reached along a 4-wheel drive track (the old Dalton Trail) running north of the Alaska Highway from Champagne or by

air, 72 km west of Whitehorse. Little is known about either the historical or current levels of fishing pressure on this lake, although it is not suspected to be very high.

Twin Lake (West) is in the Lake Laberge ecoregion of the Yukon Territory. The lake is drained by Klusha Creek and the Nordenskiold River into the Yukon River.

Sedimentary bedrock of limestone, sandstone and siltstone underlies the area. The low-lying areas are overlain with extensive glacial drift deposits of morainal and glaciofluvial material. Twin Lake is set in a broad low valley with silty and sandy soils (Oswald and Senyk 1977).

Open growth white spruce surrounds the lake, with some lodgepole pine in burned areas nearby. Feathermoss, low shrubs and grasses are also common.

Average annual temperature is -5°C, while the average annual precipitation is 247 mm (Canada, Dept. of Environment 1982).

Twin Lake has easy access, being located 116 km north of Whitehorse on the Klondike Highway. A small, Territorial campsite provides some facilities for anyone wishing to fish.

Historically, Twin Lake is believed to have received heavy fishing pressure. This has decreased to a more moderate level once the success rate decreased. Further fluctuations in activity are not anticipated, under present conditions.

Wolf Lake is within the Pelly Mountains ecoregion of the Yukon. It lies on a plateau northeast of the Englishman Range and is drained by the Wolf and Nisutlin River into Teslin Lake and the Yukon River

system.

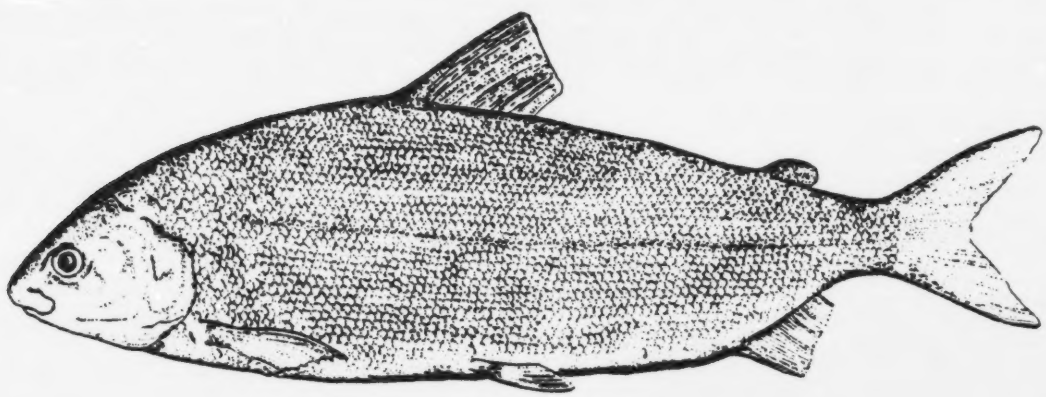
Sedimentary rocks are found underlying most of the plateau. Deep morainal and colluvial material covers much of the area (Oswald and Senyk 1977).

Black and white spruce occur around the lake with some aspen and pine. The understory consists mainly of feathermoss, willows and some sphagnum moss.

The average annual temperature is -4°C, and the average annual precipitation is approximately 400 mm (Canada, Dept. of Environment 1982).

Wolf Lake can be reached by air only, lying 192 km west of Whitehorse and 80 km west of Teslin. This large lake supports one of the few established fly-in fish camps in the Yukon.

The quota for commercial net fishing set in 1961, has never been reached and the lake is rarely utilized for this purpose. The lake receives only a moderate amount of fishing pressure, mainly from the camp. Catches which have been recorded for a number of years have fallen within proposed harvest levels.



BROAD WHITEFISH *Coregonus nasus*

3. METHODS

3.1 Fish Capture Techniques

3.1.1 Gill nets

The monofilament gill nets used during the study were composed of six panels, each measuring 15.2 m x 2.4 m , for a total net length of 91.2 m The stretched mesh sizes, as arranged from shore measured 25.4 mm, 76.2 mm, 50.8 mm, 38.1 mm 88.9 mm and 63.5 mm. Nets were set perpendicular to the shore and water depth was noted at either end.

Netting sites selected on the basis of habitat type were varied yet representative within each lake and comparable between lakes.

3.1.1.1 Summer program

During the summer of 1982, 10 lakes were sampled between July 6 and August 31. These included Alligator, Ethel, Fox, Jojo, Little Atlin, Little Salmon, Michie, Snafu, Taye and Twin (West) lakes.

A further six lakes were sampled during the summer of 1983 between July 19 and August 22. These included Big Kalzas, Claire, Dezadeash, Mayo, Quiet and Wolf lakes.

The lakes investigated were reached either by road or by air with the use of a float plane.

Two floating and two sinking nets were set overnight in each of the lakes except for two. Taye Lake was too shallow (mean depth 2.45 m) to set a sinking net, while only one net of each type could be set in Dezadeash, due to weather conditions.

Summer netting was conducted within a set seasonal time period due to the variation in the depths inhabited by lake trout during open water months.

For a summary of netting activity during the summer program see

Appendix A. Maps illustrating the locations of gillnet sets are presented in Appendix C.

3.1.1.2 Winter program

The 10 lakes which were sampled in March 1983 included Claire, Coghlan, Fox, Jojo, Little Atlin, Little Salmon, Michie, Quiet, Sekulmun and Twin (West). The lakes were reached either by road or by air using a plane on skis.

Two sinking nets were set under the ice in all lakes except Jojo and Little Salmon where only one set was possible, due to time constraints. Length of sets varied from 17 to 69 hours.

For a summary of netting activity and conditions during the winter program see Appendix B. Maps illustrating sampling locations are presented in Appendix C.

3.1.2 Seine nets

During the summer of 1982 all lakes investigated (see 3.1.1.1) were also sampled by beach seine. The net used was 61 m long and composed of 19 mm mesh. Seining was conducted in two areas of varying habitat within each lake. All samples obtained were preserved in 10% formalin (4% formaldehyde) for later identification.

Maps illustrating seining locations are presented in Appendix C.

3.2 Sampling Techniques

3.2.1 Measurements

Fish species obtained from all the netting programs were identified using the following texts: Freshwater Fishes of Northwestern Canada and Alaska (McPhail and Lindsey 1970); and/or, the Freshwater Fishes of Alaska

Plate 3. Lake trout, Big Kalzas Lake.

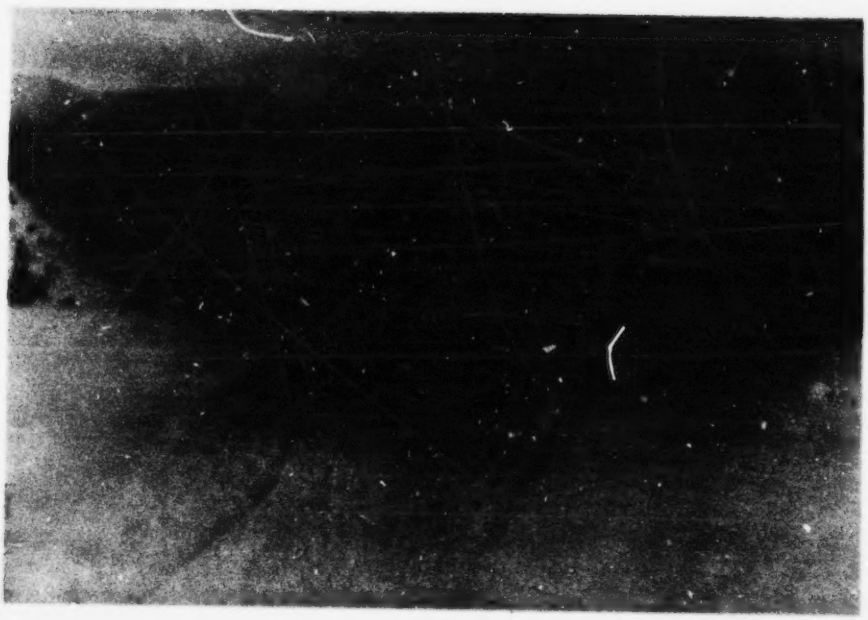


Plate 4. Winter netting program.

(Morrow 1980).

Fork length, standard length and weight were recorded for each fish. Fork length was measured in millimetres from the tip of the upper jaw to the fork of the tail. Standard length was measured from the tip of the upper jaw to the hypural notch. Whole weights were recorded to the nearest gram using either a suspended pan or a spring scale.

3.2.2 Ageing

Five scales were removed from the preferred area of all pike, grayling, cisco and whitefish (Fig. 2). Scale samples were preserved on labelled gum cards and later pressed onto acetate. Otoliths were collected from all lake trout and burbot and stored dry until they could be examined.

Age was determined from the pressed scale samples by technicians in the Department of Fisheries and Oceans' scale laboratory in Whitehorse, using standard methods. Otolith samples from the lake trout of Alligator and Jojo lakes collected during the summer of 1982 were aged by Department of Fisheries and Oceans personnel at the Freshwater Institute in Winnipeg. The remainder of the trout and burbot otoliths were interpreted in Whitehorse using a solution of 9:1 gylcerin and alcohol under a dissecting microscope.

3.2.3 Sex and Maturity

The sex of each fish was noted when possible and maturity was classified according to the following indicies:

1 - immature, no gonad development, usually difficult to determine sex;

2 - maturing, gonads developing, spawning unlikely to occur this season;

3 - mature, gonads filling 2/3 of the body cavity, will spawn this year;

4 - ripe, gonads filling body cavity, loose sex products present, eggs completely round, testes white;

5 - spent, spawned out.

This index was applied to those fish caught during the summer netting programs only.

3.2.4 Fecundity

Eggs were collected from all lake trout and preserved in Gilson's solution or 10% formalin. Fecundity was later determined by using the equation:

$$F = f \times \frac{WT}{wt},$$

where F = total number of eggs
f = number of eggs in subsample
WT = total weight of eggs in grams
wt = weight of subsample in grams

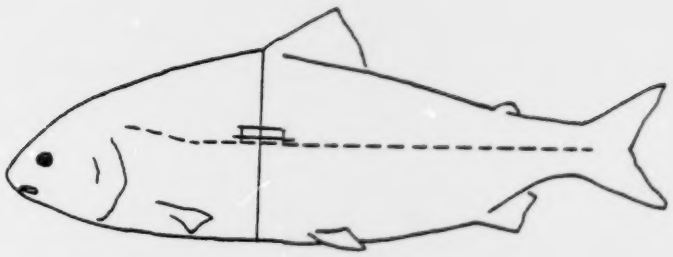
3.3 Statistical Analyses

3.3.1 Catch per unit effort

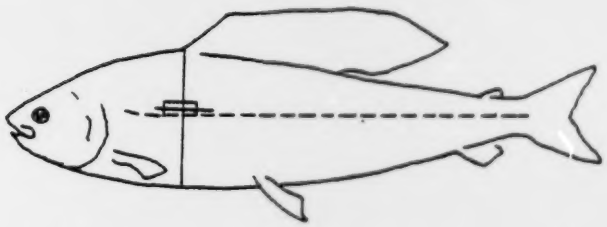
Catch per unit effort (C.P.U.E.) was calculated on the basis of number of fish caught per hour and number of grams caught per hour per standard net length. Summer and winter catches were analysed separately. For each lake the C.P.U.E. was determined for the individual species as well as for the lake as a whole.

3.3.2 Net Selectivity

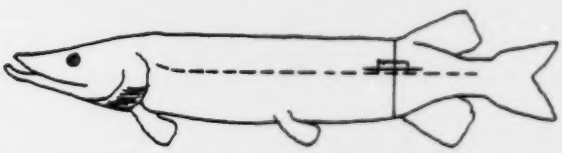
To evaluate the selectiveness of gear type the number and weight of fish caught by each mesh size in floating nets, sinking nets and both types combined were determined. This was calculated for each



whitefish



grayling



pike

preferred areas

Fig. 2. Preferred areas for the removal of scales for ageing.

Plate 5. Setting gill net, Alligator Lake.

Plate 6. Winter netting program.

species obtained as well as for the sum of all fish caught.

3.3.3 Condition

Condition (k) as an indication of fatness, was calculated for each fish using the equation: $k = \frac{W \times 10^5}{L^3}$; where W = weight in grams and L = fork length in millimetres (Bagenal 1978).

Mean k-values along with standard deviation and range were then determined for each age class, by species in each lake.

3.3.4 Sex and maturity

Sex ratios were compiled for each species within a lake. The number of males and females, the percentage of the total that they represented, and the ratio between them were tabulated.

By using the maturity indices assigned in the field, the stages of maturation for each species within a lake were determined. Development was classified into three stages. "Immature" fish were those designated by index 1, "maturing" fish by index 2, and "mature" fish as those denoted by either index 3, 4 or 5. To examine maturation trends within a lake the percentage that each of these categories represented within an age class was calculated for each species. General Yukon trends were determined by combining the results from all examined lakes.

Computations were not attempted for species where there were a large number of age classes with poor representation within each class.

3.3.5 Growth rates

Large differences in species specific growth rates in different

lakes were anticipated. The descriptors used to assess the variation in growth of the fish sampled were as follows:

i summary statistics of length, weight and age of each species within a lake system. Mean figures, determined using a Texas Instrument calculator model TI-55, were compiled to allow for general lake to lake comparisons;

ii mean, standard deviation and range values of both length and weight were determined by species for each represented age class;

iii figures were prepared illustrating the relationship between age classes and their specific mean weights with 95% confidence intervals;

iv annual growth rates were presented as a ratio of mean parameter size in age class"t + 1"versus the same parameter in age class"t," to show linear tendencies. This relationship was examined by constructing Walford plots and generating Ford equations (Ricker 1975). The Brody Growth Coefficient was derived by taking the negative natural logarithm of the slope of the line determined in the Ford equation. A hypothetical maximum or infinite parameter value (length "L_∞" or width "W_∞") was predicted from the intercept of the line described by the Ford equation with the line describing uniform absolute increase in growth over time, ie. slope equal to 1.0, origin at (0,0), as observed in the Walford Plot (Ricker 1975).

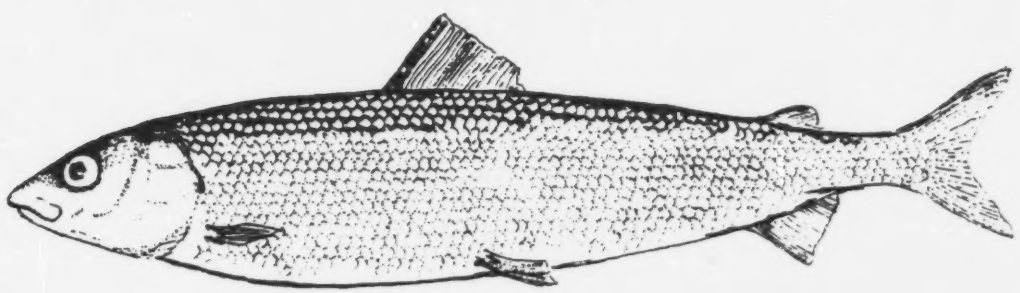
The above calculations were performed for both lengths and weights on all age classes with sample sizes ≥ 3;

v in addition to direct comparisons of these curves, equations and coefficients, analyses were conducted to determine if there were significant differences in species growth between lakes.

Lakes were ranked according to the mean weights for each age class within a range representative of each species. A grand rank was then calculated for each lake based on age class rankings. Once the grand ranks were tabulated the "Distribution-Free Test (Friedman, Kendall and Babington Smith)" was performed in order to establish whether significant differences in growth existed between the lakes for each given species (Hollander and Wolf 1977).

Once significant differences were established (in this case at a level less than 0.001) the next step was to determine which lakes specifically differed from each other, at a chosen α level of 0.05. This was evaluated using "Distribution-Free Multiple Comparisons Based on Friedman Rank Sums." (Hollander and Wolf 1977).

As these tests cannot compensate for missing data it was necessary, in some cases, to estimate the required means by using a regression equation calculated from the natural logarithms of weight and age for the specified population. This was done in cases where sample sizes were inadequate or to replace values of severely anomolous mean weights.



ROUND WHITEFISH *Prosopium cylindraceum*

4. RESULTS AND DISCUSSION

A total of 10 species of fish was recorded during this study. These included humpback, round and broad whitefish; least cisco; lake trout; Arctic grayling; northern pike; burbot; longnose sucker; and, slimy sculpin. Scientific names for these species appear in Table 3.

4.1 Species Diversity and Distribution

In terms of species diversity within each of the lakes, no one lake was found to support all ten species identified in this study. The greatest diversity occurred in Little Atlin and Little Salmon Lakes, which each recorded eight species. Ethel, Michie, Big Kalzas, Fox, Quiet and Wolf Lakes all followed closely in terms of diversification. Samples from the remaining lakes were all restricted to less than six species. Of particular interest is Taye Lake in which only northern pike was recorded. As will be explained later, poor representation of species diversity obtained from Sekulmun and Coghlan lakes can be attributed to incomplete sampling.

With regards to species distribution, lake trout were found to be the most ubiquitous, occurring in all of the eighteen lakes investigated with the exception of Taye Lake (Table 7). Northern pike, humback whitefish and round whitefish were also found to exhibit a wide distribution, with each appearing in 12 lakes. These species were followed by Arctic grayling in eight lakes, burbot and slimy sculpin in seven lakes, least cisco in six lakes, and longnose sucker in five lakes. Broad whitefish appeared to have the narrowest distribution appearing in only three lakes (Table 7).

When discussing the results pertaining to species distribution, it is important to note that the study area encompassed two separate drainage basins; the Alsek/Pacific drainage and the Yukon/Bering Sea drainage.

Within the Pacific drainage, the presence of northern pike, humpback whitefish and round whitefish in Dezadeash Lake, as reported in this study, is attributed to previous contact with the Yukon basin through historic Glacial Lake Champagne (Lindsey 1975). Elsewhere in Pacific drainages, these species have a limited distribution. For example, northern pike are not found in any other system with the exception of the Taku River. Here, northern pike have been recorded in Kuthai Lake, a small headwater lake which probably, at one time, had contact with the Yukon drainage in the Atlin area. Similarly, Arctic grayling, reported to occur in Dezadeash Lake (yet not substantiated in this study) is another species with limited populations and distribution in Pacific drainages (Lindsey et al 1981).

A homogeneous distribution of species was generally found in most lakes examined within the Yukon River drainage. Two comprehensive summaries of species presence have been recently compiled by Ennis et al. (1982A) and Lindsey et al. (1981). Excluding the presence of smaller species which this study did not encompass (i.e. lake chub, and slimy sculpin) the following disparities can be noted.

Species not recorded in the present study included: Arctic grayling in Twin; Arctic grayling and burbot in Snafu (lower), Little Salmon and Little Atlin Lakes; Arctic grayling, burbot and northern pike in Mayo Lake; northern pike and pygmy whitefish in Quiet Lake; and, lake trout and Arctic grayling in Taye Lake.

Table 7. Checklist of species recorded during the 1982/83 summer and winter lake investigations.

LAKE	Lake trout	Northern pike	Arctic grayling	Humpback whitefish	Round whitefish	Least Cisco	Burbot	Broad whitefish	Longnose sucker	Slimy sculpin	Diversity index
Alligator	X		X		X					X	4
Big Kalzas	X	X	X		X		X		X		6
Claire	X	X	X		X						4
Coghlan	X			X							2
Dezadeash	X	X		X	X				X		5
Ethel	X	X	X	X	X		X			X	7
Fox	X	X	X	X	X		X				6
Jojo	X		X		X					X	4
Little Atlin	X	X		X	X	X	X		X	X	8
Little Salmon	X	X		X	X	X		X	X	X	8
Mayo	X			X	X						3
Michie	X	X		X			X	X	X	X	7
Quiet	X		X	X	X	X	X				6
Sekulmun	X					X					2
Snafu	X	X		X		X		X			5
Taye		X									1
Twin	X	X		X		X				X	5
Wolf	X	X	X	X	X		X				6
Distributional Index	17	12	8	12	12	6	7	3	5	7	

Plate 7. Lake trout. Wolf Lake.

Plate 8. Jojo Lake.

longnose suckers were not found in Snafu and Mayo Lakes, as previously reported.

In most cases the absence of a documented species is likely to be a function of sampling techniques and behavioral characteristics of individual fish species. For example, Arctic grayling, when found in lakes, are more commonly associated with river inlets where they can take advantage of the inflowing drift for feeding. Burbot tend to display a sedentary nature and a preference for fairly deep water (Morrow 1980). As a result, these species may tend to be misrepresented in the catch unless sampling techniques are employed both temporally and spatially. Time restrictions did not always allow this to be accomplished.

The reported presence of lake trout and Arctic grayling in Taye Lake (Ennis et al 1982A) may be questioned on further examination. The occurrence of northern pike alone, as recorded in this study and in Lindsey et al,(1981), would be a reflection of the lake's low mean depth and ensuingly high MEI. While providing desirable habitat for spawning pike, the warm summer water temperatures of Taye Lake combined with its shallow and marshy characteristics, may exclude further species diversity. Arctic grayling may be associated with the lake's companion river systems, but lake trout are not likely to be found in residence under these conditions.

Not previously reported is the presence of broad whitefish in Snafu Lake, broad whitefish in Michie Lake, pike and humpback whitefish in Ethel Lake and grayling and humpback whitefish in Wolf Lake.

The presence of the large spotted variety of least cisco was confirmed in Quiet Lake (Lindsey et al 1981).

In view of the limitations imposed by winter sampling

conditions, the results from Sekulmun and Coghlan Lakes cannot be expected to accurately reflect species diversity and/or abundance (see section 4.2). Poor weather conditions precluded any summer sampling in both these lakes. Besides the presence of lake trout and humpback whitefish in Coghlan Lake, as noted in this study, Arctic grayling, burbot and northern pike have been previously reported. And, in addition to lake trout and burbot, Arctic grayling, northern pike, humpback whitefish and round whitefish had also been previously reported in Sekulmun Lake (Ennis et al 1982A).

The bathymetry of Little Atlin lake which exhibits extensive shore development, prevented any net set from shore from reaching sufficient depth, ie. below the thermocline, so as to penetrate the mid-summer habitat of lake trout. Consequently, trout were not recorded in the summer catch. They did appear, however, during the winter sampling program.

4.2 Catch Analysis

Results from the gill netting programs are summarized by season, lake and species in Tables 8 and 9.

For the summer netting activities, specific details pertaining to date, time, type of gill net , duration and depth of set and comments regarding shoreline and lake bottom composition are presented in Appendix A. Netting locations are illustrated in Appendix C.

Samples of all 10 species identified in this study except slimy sculpin were obtained during the summer gill netting program. Within the 16 lakes investigated over the two years, sample sizes varied greatly from 22 fish in Taye Lake to 277 fish in Quiet Lake, with a

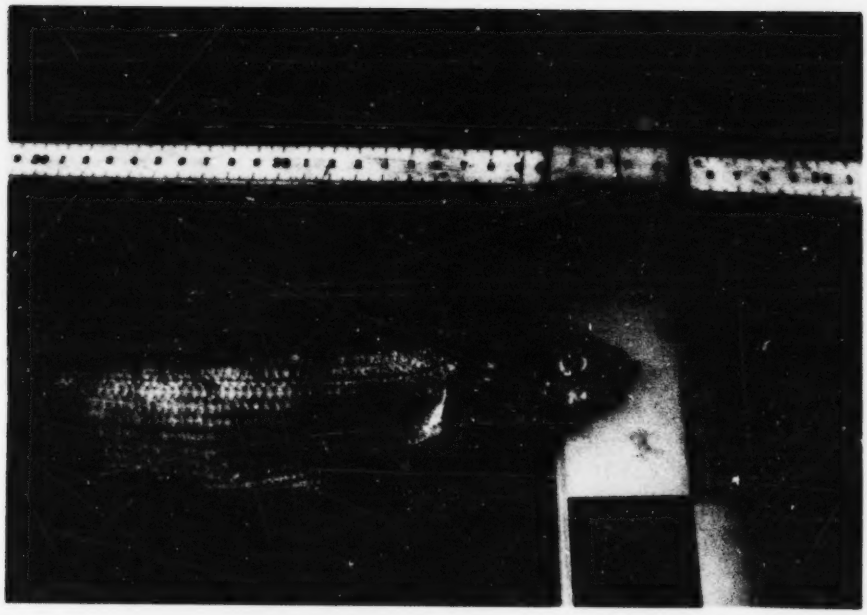


Plate 9. Least cisco, large spotted variety, Quiet Lake.

Plate 10. Arctic grayling, Quiet Lake.

TABLE 8. Summary of catch composition, summer programs 1982-83.

	ALLIGATOR				BIG KALZAS			
SPECIES	N	(%)	WT (kg)	(%)	N	(%)	WT (kg)	(%)
All	271	(100.0)	152.64	(100.0)	71	(100.0)	57.45	(100.0)
Lake trout	130	(48.0)	107.90	(70.7)	36	(50.7)	33.50	(58.3)
Northern pike	0		0		3	(4.2)	3.26	(5.7)
Arctic grayling	141	(52.0)	44.74	(29.3)	1	(1.4)	0.24	(0.4)
Humpback whitefish	0		0		0		0	
Round whitefish	0		0		24	(33.8)	16.72	29.1)
Least cisco	0		0		0		0	
Burbot	0		0		5	(7.1)	2.10	3.6
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		2	(2.8)	1.61	2.8)

	CLAIRE				DEZADEASH			
SPECIES	N	(%)	WT	(%)	N	(%)	WT	(%)
All	156	(100.0)	90.44	(100.0)	220	(100.0)	152.29	(100.0)
Lake trout	58	(37.1)	27.19	(30.1)	33	(15.0)	75.01	(49.3)
Northern pike	14	(9.0)	31.31	(34.6)	1	(0.5)	3.50	(2.3)
Arctic grayling	51	(32.7)	18.09	(20.0)	0		0	
Humpback whitefish	0		0		96	(43.6)	35.14	(23.1)
Round whitefish	33	(21.2)	13.85	(15.3)	75	(34.1)	20.54	(13.4)
Least cisco	0		0		0		0	
Burbot	0		0		0		0	
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		15	6.8)	18.1	11.9)

	ETHEL				FOX			
SPECIES	N	(%)	WT (kg)	(%)	N	(%)	WT (kg)	(%)
All	164	(100.0)	110.29	(100.0)	148	(100.0)	105.29	100.0)
Lake trout	22	(13.4)	17.22	(15.6)	21	(14.2)	19.50	(18.5)
Northern pike	4	(2.5)	11.65	(10.6)	6	(4.1)	6.28	6.0)
Arctic grayling	13	(7.9)	5.60	(5.1)	43	(29.0)	13.58	(12.9)
Humpback whitefish	57	(34.7)	58.09	(52.7)	59	(39.9)	57.92	55.0)
Round whitefish	68	(41.5)	17.73	16.1)	19	(12.8)	8.01	7.6
Least cisco	0		0		0		0	
Burbot	0		0		0		0	
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		0		0	

TABLE 8. Continued .

SPECIES	JOJO N	(%)	JOJO WT (kg)	(%)	LITTLE ATLIN N	(%)	LITTLE ATLIN WT (kg)	(%)
All	169	(100.0)	71.50	(100.0)	115	(100.0)	118.19	(100.0)
Lake trout	146	(86.4)	62.18	(87.0)	0		0	
Northern pike	0		0		28	(24.3)	47.94	(40.6)
Arctic grayling	23	(13.6)	9.32	(13.0)	0		0	
Humpback whitefish	0		0		77	(67.0)	61.5	(52.0)
Round whitefish	0		0		2	(1.7)	0.65	(0.5)
Least cisco	0		0		1	(0.9)	0.15	(0.1)
Burbot	0		0		0		0	
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		7	6.1	7.95	(6.7)

SPECIES	LITTLE SALMON N	(%)	LITTLE SALMON WT (kg)	(%)	MAYO N	(%)	MAYO WT (kg)	(%)
All	78	(100.0)	73.91	(100.0)	65	(100.0)	48.37	(100.0)
Lake trout	21	(26.9)	26.91	(36.4)	2	(3.1)	2.39	(4.9)
Northern pike	1	(1.3)	3.50	(4.8)	0		0	
Arctic grayling	0		0		0		0	
Humpback whitefish	26	(33.3)	32.32	(43.7)	45	(69.2)	40.30	(83.4)
Round whitefish	13	(16.7)	8.61	(11.6)	18	(27.7)	5.68	(11.7)
Least cisco	3	(3.9)	1.00	(1.4)	0		0	
Burbot	0		0		0		0	
Broad whitefish	5	(6.4)	0.39	(1.2)	0		0	
Longnose sucker	9	(11.5)	0.68	(0.9)	0		0	

SPECIES	MICHIE N	(%)	MICHIE WT (kg)	(%)	QUIET N	(%)	QUIET WT (kg)	(%)
All	50	(100.0)	39.25	(100.0)	277	(100.0)	91.18	(100.0)
Lake trout	7	(14.0)	7.62	(19.4)	25	(9.0)	16.53	(18.1)
Northern pike	5	(10.0)	6.37	(16.2)	0		0	
Arctic grayling	0		0		56	20.2)	11.84	(13.0)
Humpback whitefish	32	(64.0)	21.73	(55.4)	14	(5.1)	12.27	(13.5)
Round whitefish	0		0		131	(47.3)	35.62	(39.0)
Least cisco	0		0		39	(14.1)	7.02	(7.7)
Burbot	2	(4.0)	2.45	(6.2)	12	(4.3)	7.90	(8.7)
Broad whitefish	4	(8.0)	1.08	(2.8)	0		0	
Longnose sucker	0		0		0		0	

TABLE 8. Continued.

SPECIES	SNAFU N	(%)	WT (kg)	(%)	TAYE N	(%)	WT (kg)	(%)
All	113	(100.0)	44.35	(100.0)	22	(100.0)	18.96	(100.0)
Lake trout	2	(1.8)	1.48	(3.3)	0		0	
Northern pike	17	(15.1)	23.60	(53.2)	22	(100.0)	18.96	(100.0)
Arctic grayling	0		0		0		0	
Humpback whitefish	18	(15.9)	7.98	(18.0)	0		0	
Round whitefish	0		0		0		0	
Least cisco	66	(58.4)	8.19	(18.5)	0		0	
Burbot	0		0		0		0	
Broad whitefish	10	(8.8)	3.10	(7.0)	0		0	
Longnose sucker	0		0		0		0	

SPECIES	TWIN N	(%)	WT (kg)	(%)	WOLF N	(%)	WT (kg)	(%)
All	72	(100.0)	68.23	(100.0)	176	(100.0)	96.15	(100.0)
Lake trout	17	(23.6)	20.50	(30.0)	22	(12.5)	33.80	(35.2)
Northern pike	13	(18.1)	26.06	(38.2)	1	(0.6)	2.75	(2.9)
Arctic grayling	0		0		33	(18.8)	9.92	(10.3)
Humpback whitefish	14	(19.4)	16.52	(24.3)	25	(14.2)	28.64	(29.8)
Round whitefish	0		0		94	(53.4)	20.72	(21.5)
Least cisco	28	(38.9)	5.15	(7.5)	0		0	
Burbot	0		0		1	(0.5)	0.32	(0.3)
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		0		0	

TABLE 9. Summary of catch composition, winter program 1983.

	ALLIGATOR				CLAIRE			
SPECIES	N	(%)	WT (kg)	(%)	N	(%)	WT (kg)	(%)
All	53	(100.0)	52.35	(100.0)	6	(100.0)	5.49	(100.0)
Lake trout	53	(100.0)	52.35	(100.0)	6	(100.0)	5.49	(100.0)
Northern Pike	0		0		0		0	
Arctic grayling	0		0		0		0	
Humpback whitefish	0		0		0		0	
Round whitefish	0		0		0		0	
Least cisco	0		0		0		0	
Burbot	0		0		0		0	
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		0		0	

	COGHLAN				FOX			
SPECIES	N	(%)	WT (kg)	(%)	N	(%)	WT (kg)	(%)
All	18	(100.0)	27.00	(100.0)	12	(100.0)	12.16	(100.0)
Lake trout	17	(94.0)	24.2	(89.6)	6	(50.0)	6.63	(54.5)
Northern pike	0		0		0		0	
Arctic grayling	0		0		0		0	
Humpback whitefish	1	(6.0)	2.8	(10.4)	4	(33.3)	3.43	(28.2)
Round whitefish	0		0		0		0	
Least cisco	0		0		0		0	
Burbot	0		0		2	(16.7)	2.10	(17.3)
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		0		0	

	JOJO				LITTLE ATLIN			
SPECIES	N	(%)	WT (kg)	(%)	N	(%)	WT (kg)	(%)
All	32	(100.0)	17.60	(100.0)	112	(100.0)	71.16	(100.0)
Lake trout	32	(100.0)	17.60	(100.0)	6	(5.4)	9.29	(13.1)
Northern pike	0		0		2	(1.8)	9.36	(13.9)
Arctic grayling	0		0		0		0	
Humback whitefish	0		0		67	(59.8)	37.70	(52.9)
Round whitefish	0		0		25	(22.3)	3.23	(4.5)
Least cisco	0		0		0		0	
Burbot	0		0		12	(10.7)	11.10	(15.6)
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		2		0	

TABLE 9. Continued.

SPECIES	LITTLE SALMON N	(%)	WT (kg)	(%)	MICHIE N	(%)	WT (kg)	(%)
All	12	(100.0)	12.69	(100.0)	45	(100.0)	[illegible]	(100.0)
Lake trout	4	(33.3)	3.34	(26.3)	6	(13.4)	15.08	(33.9)
Northern pike	0		0		4	(8.9)	8.56	(19.2)
Arctic grayling	0		0		0		0	
Humpback whitefish	8	(66.7)	9.35	(73.7)	33	(73.3)	17.51	(39.4
Round whitefish	0		0		0		0	
Least cisco	0		0		0		0	
Burbot	0		0		1	(2.2)	1.61	(3.6)
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		1	(2.2)	1.68	(3.8)

SPECIES	QUIET N	(%)	WT (kg)	(%)	SEKULMUN N	(%)	WT (kg)	(%)
All	41	(100.0)	74.57	(100.0)	14	(100.0)	18.[illegible]	(100.0)
Lake trout	7	(17.1)	7.35	(9.9)	9	(64.3)	15.88	(86.1)
Northern pike	0		0		0		0	
Arctic grayling	0		0		0		0	
Humpback whitefish	17	(41.5)	23.18	(31.0)	0		0	
Round whitefish	16	(39.0)	43.40	(58.2)	0		0	
Least cisco	0		0		0		0	
Burbot	1	(2.4)	0.64	(0.9)	5	(35.7)	2.56	(13.9)
Broad whitefish	0		0		0		0	
Longnose sucker	0		0		0		0	

SPECIES	TWIN N	(%)	WT (kg)	(%)
All	69	(100.0)	36.73	(100.0)
Lake trout	14	(20.3)	10.76	(29.3)
Northern pike	0		0	
Arctic grayling	0		0	
Humpback whitefish	51	(73.9)	25.68	(69.9)
Round whitefish	0		0	
Least cisco	4	(5.8)	0.29	(0.8)
Burbot	0		0	
Broad whitefish	0		0	
Longnose sucker	0		0	

mean of 135. (Comparative catch and effort analysis appears later in section 4.3.)

Of the total summer sample consisting of 2167 fish, whitefish spp. (humpback, round, broad, least cisco) accounted for 50.6%, followed by lake trout (25.0%), Arctic grayling (16.7%) and northern pike (5.3%). In terms of catch by weight, whitefish spp. represented 40.5% and lake trout 33.7% of the total 1338.5 kg. caught. Of the remainder, northern pike and Arctic grayling made up 13.8% and 7.9% respectively.

During the winter sampling program which encompassed 11 lakes, gill nets captured seven species. Samples of Arctic grayling, broad whitefish and slimy sculpin were not obtained. Winter gill netting results are summarized in Table 9. Specific details concerning set times, depth and ice conditions are given in Appendix B.

Whitefish spp. and lake trout composed 55.1% and 38.6% respectively of the total 414 fish caught. Only six northern pike were reported. A total of 373.2 kg was caught composed of 45.1% lake trout and 44.6% whitefish spp. As with the summer program, sample sizes varied considerably from lake to lake ranging from 6 fish in Claire Lake to 112 fish in Little Atlin. The mean sample size was 38. Further analysis of catch and effort appears in Section 4.3.

The use of seine nets was restricted to the 1982 summer season only. They proved to be relatively ineffective given the limited sampling time available in each lake.

Results of the beach seining activities are summarized in Table 10. Eight species were represented in the overall catch of 76 fish.

Table 10. Summary of beach seine contents, summer 1982

	SEINE A			SEINE B		
LAKE	SPECIES	N	WEIGHT (g)	SPECIES	N	WEIGHT (g)
Alligator	grayling	2	2.53	grayling	4	7.24
	sculpin	2	2.12	sculpin	3	5.30
				round whitefish	1	0.59
Ethel	burbot	4	1.35	burbot	1	0.40
	round whitefish	2	1.55	round whitefish	5	9.83
	sculpin	1	1.10			
Fox	round whitefish	2	2.83	humpback whitefish	3	18.78
Jojo	sculpin	7	5.87	sculpin	6	2.79
	round whitefish	1	-			
Little Atlin	pike	1	14.56	sucker	1	0.37
	sucker	1	1.06	sculpin	2	3.40
	sculpin	1	3.87			
Little Salmon	round whitefish	2	3.25	sculpin	2	3.69
	sculpin	3	0.88			
Michie	sucker	1	0.50	sucker	4	0.36
	sculpin	2	0.12	sculpin	4	9.76
				burbot	1	0.97
Twin	least cisco	1	0.75	sculpin	4	4.86
	sculpin	2	1.54			

Of these, slimy sculpins represented 51.3%, whitefish spp. 22.3%, longnose suckers 9.2% and burbot 7.9%. Lake trout and broad whitefish were not captured. The selective nature of beach seines towards juvenile and/or small fish is reflected in the low total weight of the sample which was 112.2 grams. The greatest portion of the catch by weight consisted of slimy sclupin (40.4%), followed by whitefish spp. (32.9%), northern pike (13.0%),and Arctic grayling (8.7%). However, it should be noted that only one pike was caught which, because of its weight, (14.6 g) tended to give this species a misleading representation in terms of the overall catch by weight.

When comparing seasonal results, two basic characteristics emerge. The winter catches, generally reflect a lower diversity of species and smaller sample sizes in spite of longer set times. Fishing techniques combined with behavioral characteristics of the individual species, such as reduced swimming activity in winter (due to temperature induced lower energy levels) and/or changes in seasonal habitat preferences are likely contributors to these differences.

Another factor which undoubtedly influenced the winter fishing results involved the technical aspects of setting nets under ice. Procedures such as the initial inspection of actual netting sites and exact orientation of the nets were somewhat restricted. In addition, floating nets were not used due to the tendency of the net corks to freeze into the ice layer. This lead to the placement of nets in depths generally greater than 3.5 metres.

4.3 Catch per Unit Effort (C.P.U.E.)

Results from catch per unit effort calculations based on the number of fish caught per hour and the weight of fish caught per hour are presented in Table 11. In all cases the numbers correspond to a standarized length of net required to permit meaningful comparisons both seasonally within lakes or amongst lakes.

As previously observed, the catch per unit effort of all species combined within specific lakes was far greater in summer than winter. In the nine lakes where C.P.U.E. data exists for both seasons, the mean summer C.P.U.E. was 2.57 fish/hr as compared to 0.62 fish/hr in winter. Overall, the highest winter values were obtained in Jojo Lake (1.64 fish/hr) and Little Atlin Lake (1.24 fish/hr). Summer values were greatest in Alligator Lake (5.02 fish/hr) and Quiet Lake (4.67 fish/hr). In terms of weight, greatest yields were obtained in Wolf Lake, at 2.16 kg/hr and Little Atlin, at 2.15 kg/hr during the summer (Table 11).

When examining the C.P.U.E. data for lake trout, notably higher values were found in Jojo and Alligator Lakes with values in excess of 2.4 fish/hr The remaining lakes all had values of less than 1.0 fish/hr Whenever lake trout and northern pike occurred simultaneously in the catch, C.P.U.E. values for pike were, on the average, about one quarter the lake trout values (based on summer values). Snafu Lake was the only lake in which the relative abundance of northern pike appeared to be greater than lake trout (Table 11).

Highest C.P.U.E. values for northern pike were recorded in Taye, Little Atlin and Snafu Lakes, whereas Alligator, Quiet and Claire

Table 11 . Catch Per Unit Effort - All Nets.

LAKE		ALL SPECIES		TROUT		PIKE		GRAYLING		HUMPBACK WHITEFISH		ROUND WHITEFISH		LEAST CISCO		BURBOT		BROAD WHITEFISH		LONGNOSE SUCKERS	
		FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR	FISH/ HR	GM/ HR
Alligator	Summer	5.02	1796	2.41	1269	0	0	2.61	526	0	0	0	0	0	0	0	0	0	0	0	0
	Winter	0.95	927	0.95	927	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Kalzas	Summer	1.36	1037	0.69	577	0.06	63	0.02	5	0	0	0.46	321	0	0	0.09	40	0	0	0.04	31
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Claire	Summer	2.72	1754	0.91	500	0.26	663	0.94	335	0	0	0.61	256	0	0	0	0	0	0	0	0
	Winter	0.05	41	0.05	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coghlan	Summer	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
	Winter	0.41	621	0.39	556	0	0	0	0	0.02	64	0	0	0	0	0	0	0	0	0	0
Dezadeash	Summer	1.26	970	0.23	514	0.01	24	0	0	0.60	172	0.25	79	0	0	0.07	20	0	0	0.10	161
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Ethel	Summer	2.86	1799	0.41	297	0.07	201	0.23	97	0.98	898	1.17	306	0	0	0	0	0	0	0	0
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Fox	Summer	1.89	1430	0.29	287	0.09	92	0.32	199	0.89	852	0.30	118	0	0	0	0	0	0	0	0
	Winter	0.19	196	0.10	107	0	0	0	0	0.06	55	0	0	0	0	0.03	33	0	0	0	0
Jojo	Summer	3.06	1172	2.68	1019	0	0	0.38	153	0	0	0	0	0	0	0	0	0	0	0	0
	Winter	1.64	903	1.64	903	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Atlin	Summer	2.10	2150	0	0	0.51	872	0	0	1.40	1119	0.04	12	0.02	3	0	0	0	0	0.13	145
	Winter	1.24	645	0.07	102	0.02	108	0	0	0.75	278	0.27	35	0	0	0.13	122	0	0	0	0
Little Salmon	Summer	1.19	1263	0.36	464	0.02	60	0	0	0.45	557	0.22	148	0.05	17	0	0	0.09	15	0	0
	Winter	0.27	212	0.09	74	0	0	0	0	0.18	208	0	0	0	0	0	0	0	0	0	0
Mayo	Summer	1.28	921	0.04	45	0	0	0	0	0.86	768	0.38	108	0	0	0	0	0	0	0	0
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Michie	Summer	1.00	755	0.14	147	0.10	123	0	0	0.62	418	0	0	0	0	0.06	67	0.08	42	0	0
	Winter	0.59	595	0.08	196	0.05	110	0	0	0.44	226	0	0	0	0	0.01	43	0	0	0.01	20
Quiet	Summer	4.67	1713	0.36	290	0	0	0.97	204	0.24	211	2.22	610	0.67	121	0.21	277	0	0	0	0
	Winter	0.49	414	0.08	89	0	0	0	0	0.20	263	0.19	54	0	0	0.02	8	0	0	0	0
Sekulman	Summer	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
	Winter	0.39	519	0.25	447	0	0	0	0	0	0	0	0	0	0	0.14	72	0	0	0	0
Snafu	Summer	2.18	1109	0.04	285	0.33	454	0	0	0.35	153	0	0	1.27	157	0	0	0.19	59	0	0
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Taye	Summer	0.76	654	0	0	0.76	654	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
Twin	Summer	1.49	1421	0.35	427	0.27	543	0	0	0.29	344	0	0	0.58	107	0	0	0	0	0	0
	Winter	0.23	394	0.18	138	0	0	0	0	0.05	256	0	0	0	0	0	0	0	0	0	0
Wolf	Summer	3.55	2162	0.41	690	0.02	56	0.67	405	0.51	584	1.92	421	0	0	0.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Winter	N/A		N/A		N/A		N/A		N/A		N/A		N/A		N/A		[illegible]		N/A	

lakes ranked highest in terms of Arctic grayling.

Based on the summer C.P.U.E. values for the primary game fish species, the following summary highlights the lakes in which the highest values were obtained:

C.P.U.E.	LAKE TROUT	NORTHERN PIKE	ARCTIC GRAYLING
Fish/hr	2.68 - Jojo	0.76 - Taye	2.61 - Alligator
Kg/hr	1.27 - Alligator	0.87 - Little Atlin	0.53 - Alligator

These C.P.U.E. results may be useful in indicating probabilities for both fishing success and quality. For example, from the above one might expect to catch more lake trout in Jojo than in Alligator Lake although larger fish would more likely be encountered in Alligator Lake (see Section 4.5).

Lakes with moderate to high values in both fish/hr and kg /hr would be best suited for non-specific fishermen. In this regard, of the fly-in lakes examined, Alligator, Jojo and Claire Lakes ranked highest in terms of aggregate C.P.U.E. values for lake trout, northern pike and Arctic grayling. Quiet, Ethel and Fox Lakes represented the top road access lakes although the aggregate C.P.U.E. values for these lakes were much smaller than those for the fly-in lakes.

A final note of caution must be added when interpreting the preceding rankings. The netting programs conducted in each lake were by necessity, carried out in a very expeditious manner. An intensive investigation, besides being prohibited by time restraints, was not

felt to be highly desirable given a certain sensitivity towards the capture of a large number of fish, particularly lake trout. Comparative stock abundance was not a primary objective of this study. Had it been, a much more intensive sampling program would have been necessary. Changes in methodology would have required consideration given a recent conclusion that the sole use of multi-mesh gillnets is questionable in terms of making comparisons in stock abundance (Craig and Fletcher 1981). As a consequence, the rankings obtained should be used only as general indicators.

4.4 Net Selectivity

Although varying between species, an analysis of gill net selectivity showed the 76.2 mm mesh to be overall the most efficient size of those used in the study. When all species were combined, the sinking nets were found to catch a greater number of fish than the floaters, although the average weight in each net type was approximately the same.

Tables 12 to 14 show the distribution of weights and numbers by the various mesh sizes and net types for each lake and species.

The greatest number and weight of lake trout were obtained in the 88.9 mm sinking net although the average weight of the individual trout caught was higher in the floating nets. The 76.2 mm nets overall, secured the largest catch of both northern pike and humpback whitefish. Round whitefish were more often caught in the 50.8 mm mesh, with the sinking nets proving more efficient in terms of both numbers and average weights.

The selectivity of fishing gear for size and species can be

Table 12 . Number and weight for all species caught during the study in the float nets

	25.4 mm			38.1 mm			50.8 mm			63.5 mm		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	107	5.88	0.05	116	58.86	0.50	209	149.55	0.72	117	90.61	0.77
trout	9	3.03	0.34	12	11.25	0.94	38	55.35	1.46	31	25.69	0.83
pike	2	1.08	0.54	10	15.18	1.52	13	16.37	1.26	6	8.25	1.38
grayling	33	0.84	0.03	9	2.72	0.30	34	12.59	0.37	20	8.23	0.41
humpback whitefish	11	0.25	0.02	17	16.53	0.97	56	37.24	0.67	39	36.41	0.93
round whitefish	44	0.46	0.01	36	7.47	0.21	53	14.53	0.27	10	3.56	0.36
least cisco	7	0.21	0.03	30	2.54	0.08	2	1.15	0.58	2	0.60	0.30
burbot	-	-	-	2	3.18	1.59	4	0.81	0.20	5	4.93	0.99
broad whitefish	1	0.03	0.03	-	-	-	1	0.80	0.80	1	0.29	0.29
longnose suckers	-	-	-	-	-	-	8	10.73	1.34	3	2.66	0.89

	76.2 mm			88.9 mm			TOTAL		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	144	132.87	0.92	90	81.97	0.98	783	519.74	0.66
trout	30	27.03	0.90	21	23.06	1.10	141	145.41	1.03
pike	22	38.12	1.73	11	18.15	1.65	64	97.15	1.52
grayling	40	19.76	0.49	22	14.74	0.67	158	58.88	0.37
humpback whitefish	38	38.55	1.01	21	19.21	0.91	182	148.19	0.81
round whitefish	9	4.37	0.49	8	1.41	0.18	160	31.8	0.20
least cisco	1	1.25	1.25	-	-	-	42	5.75	0.14
burbot	3	2.39	0.80	7	5.39	0.77	21	16.70	0.80
broad whitefish	-	-	-	-	-	-	3	1.12	0.37
longnose suckers	1	1.40	1.40	-	-	-	12	14.79	1.23

Table 13 . Number and weight for all species caught during the study in sink nets

	25.4 mm			38.1 mm			50.8 mm			63.5 mm		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	126	18.68	0.15	337	122.84	0.36	336	149.39	0.44	236	181.31	0.77
trout	22	7.69	0.35	106	53.24	0.50	98	46.17	0.47	102	106.33	1.04
pike	6	2.50	0.42	5	9.58	1.92	10	25.53	2.55	2	3.60	1.80
grayling	62	2.02	0.03	29	6.98	0.24	48	10.90	0.23	8	3.61	0.45
humpback whitefish	16	4.52	0.28	58	22.51	0.39	65	31.84	0.49	59	41.73	0.71
round whitefish	15	1.62	0.11	97	22.28	0.23	83	29.03	0.35	46	16.08	0.35
least cisco	5	0.31	0.06	35	6.43	0.18	29	3.84	0.13	1	0.40	0.40
burbot	-	-	-	2	0.16	0.08	-	-	-	6	2.64	0.44
broad whitefish	-	-	-	3	0.06	0.02	2	0.40	0.20	8	2.56	0.32
longnose suckers	-	-	-	2	1.61	0.81	1	1.67	1.67	4	4.36	1.09

	76.2 mm			88.9 mm			TOTAL		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	439	412.43	0.94	287	291.27	1.01	1761	1175.92	0.67
trout	109	117.74	1.08	168	187.16	1.11	605	518.33	0.86
pike	30	63.51	2.12	4	6.23	1.56	57	110.95	1.95
grayling	45	23.61	0.52	10	6.75	0.68	202	53.87	0.27
humpback whitefish	164	143.95	0.88	83	74.51	0.90	445	319.06	0.72
round whitefish	74	43.43	0.59	6	2.63	0.44	321	115.07	0.36
least cisco	10	12.07	1.21	-	-	-	80	23.05	0.29
burbot	1	1.20	1.20	10	7.74	0.77	19	11.74	0.62
broad whitefish	2	0.73	0.37	1	0.20	0.20	16	3.95	0.25
longnose suckers	4	6.19	1.55	5	6.05	1.21	16	19.88	1.24

Table 14 . Number and weight for all species caught during the study in both float and sink nets.

	25.4 mm			38.1 mm			50.8 mm			63.5 mm		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	233	24.56	0.11	453	181.70	0.40	517	298.94	0.58	353	271.92	0.77
trout	31	10.73	0.35	118	64.49	0.55	136	101.52	0.75	133	132.02	0.99
pike	8	3.58	0.45	15	24.76	1.65	23	41.89	1.82	8	11.85	1.48
grayling	95	2.86	0.03	38	9.70	0.26	82	23.49	0.29	28	11.84	0.42
humpback whitefish	27	4.76	0.18	75	39.04	0.52	121	69.08	0.57	98	78.14	0.80
round whitefish	59	2.08	0.04	133	29.75	0.22	136	43.56	0.32	56	19.64	0.35
least cisco	12	0.52	0.04	65	8.96	0.14	3	4.99	1.66	3	1.00	0.33
burbot	-	-	-	4	0.47	0.12	4	0.81	0.20	11	7.56	0.69
broad whitefish	1	0.03	0.03	3	0.06	0.02	3	1.20	0.40	9	2.85	0.32
longnose suckers	-	-	-	2	1.61	0.81	9	12.40	1.38	7	7.02	1.00

	76.2 mm			88.9 mm			TOTAL		
SPECIES	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)	N	TOTAL WT (kg)	MEAN WT (kg)
all species	583	545.30	0.94	377	373.24	0.99	2516	1695.66	0.67
trout	139	144.76	1.04	189	210.22	1.11	746	972.50	1.30
pike	52	101.63	1.95	15	24.38	1.63	121	208.09	1.72
grayling	85	43.38	0.51	32	21.49	0.67	360	112.76	0.31
humpback whitefish	202	182.49	0.90	104	93.72	0.90	627	467.23	0.75
round whitefish	83	47.79	0.58	14	4.04	0.29	481	146.86	0.31
least cisco	11	13.32	1.21	-	-	-	94	28.79	0.31
burbot	4	3.59	0.90	17	13.14	0.77	40	25.57	0.64
broad whitefish	2	0.73	0.37	1	0.20	0.20	19	5.07	0.27
longnose suckers	5	7.59	1.52	5	6.05	1.21	28	34.67	1.24

effected by both extrinsic and intrinsic factors (Bagenal 1978).

Extrinsic effects, such as species behavior in relation to season, time, habits or size can be reduced by attempting to maintain a consistency in netting procedure.

Behavioral characteristics, such as habitat preferences were considered when choosing net sites. When possible, attempts were made to reduce the variation in both bottom type and depth of sets between the various lakes. Location within a lake system, ie. the proximity of inlets or outlets, proved to have an influence on the number of grayling that were caught.

The absence of young trout is probably more a reflection of habitat preference than of netting selectivity, as samples of young, small fish of other species were obtained.

Summer sets were made overnight, covering a period of 12 to 74 hours (Appendix A). The term overnight is used somewhat loosely as the actual extent of darkness in the Yukon during the time of the study varied from 3 to 5 hours. Thus any periods where fish movement was triggered by declining, increasing or low light levels were covered.

In some respects, the winter gillnet sets were more random, in that habitat could not always be determined due to ice and snow cover. Lack of information on behaviour and habitat preference during the winter months reduced the ability to select representative sites for netting. To secure sufficient samples, longer sets were initiated in an attempt to compensate for the reduced movement during the winter.

The main intrinsic factor effecting selectivity in this study is

the range of mesh sizes which comprised the gill nets, although other considerations such as hanging ratios, size of panels, orientation toward shore and possible tangling would also have contributed to some extent. This could have had two direct consequences: first, on the species caught; and second, on the size of the individual fish and hence the mean size of the catch (Hamley 1975).

In considering the former, there is no indication that the range of mesh sizes was inadequate to provide a representation of species present within a system. Throughout the study, the nets continually demonstrated the ability to capture a wide range of size and form (excluding very small species which are rarely captured by gill nets). As previously discussed, the absence of a reported species in the catch is more likely a function of sampling intensity, location and fish behaviour than of a gear type which has proven effective in other lakes.

Size selectivity by mesh size effects the representation of existing age classes as well as the calculation of species abundance. In addition, growth curve calculations are influenced by a mesh sizes' predisposition to catch larger fish of the youngest age classes and smaller representatives of the upper age classes. It is therefore necessary when examining catch statistics to assess a net's ability to select a representative sample from each species present.

Previous investigations using multi-mesh nets to a maximum of 140 mm mesh (Moshenko and Low 1978; Berst 1961; Bond 1976) caught the major portion of samples of cisco, pike, burbot, suckers and/or round whitefish in stretched meshes of 88 mm or less. By comparison, these results would indicate that the samples of these species obtained during this study were not limited by mesh size, and provided a good

representation of the resident populations.

The use of larger mesh in this study would have undoubtedly had an effect on the structure and proportions of the catch. While the use of larger mesh would not necessarily have caught larger fish, it would however, have caught more fish of larger size and thereby increased the mean size. Possible exceptions to this assumption, are lake trout and northern pike which, because of their teeth, are vulnerable to a wider range of mesh sizes.

Comparisons between gill net and sport catches were made in order to provide some clarification. Creel census and fishing derby data collected from 1981 to 1983 for Little Salmon and Fox Lakes show the average weight of angled trout to be 995 g and 832 g respectively. (Horler and Jarvis in prep.; Dept. of Fisheries in prep.). This compares to mean weights of 1210 g and 1005 g for fish caught in this study by multi-mesh gillnets. This would seem to indicate that the nets were obtaining samples that were slightly larger but still representative of the lake trout angled in these lakes.

As the relationship between size and age in trout varies significantly from lake to lake (see Section 4.8) the effect(s) that a reduced representation of larger fish has has on any specific growth curve are difficult to predict.

4.5 Mean Size and Condition Factors (k)

Mean weights, fork lengths and condition factors for lake trout, northern pike, Arctic grayling, whitefish spp, longnose sucker and burbot are presented in Tables 15 to 23. The following is a brief summary of these results by each species.

TABLE 15. Average length,weight,K and age of the lake trout catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Alligator	388	(181)	888	(181)	1.37	(178)	16.5	(139)
Big Kalzas	407	(34)	907	(33)	1.09	(33)	15.8	(31)
Claire	322	(55)	450	(52)	1.16	(53)	10.1	(51)
Coghlan	424	(17)	1424	(17)	1.34	(17)	15.2	(16)
Dezadeash	537	(33)	2273	(33)	1.32	(33)	15.9	(32)
Ethel	356	(24)	718	(24)	1.23	(24)	18.4	(12)
Fox	403	(26)	1005	(26)	1.19	(26)	16.9	(21)
Jojo	313	(177)	451	(177)	1.18	(177)	12.6	(153)
Little Atlin	452	(6)	1548	(6)	1.38	(6)	19.2	(5)
Little Salmon	448	(25)	1210	(25)	1.15	(25)	18.4	(19)
Mayo	461	(2)	1193	(2)	1.17	(2)	13.5	(2)
Michie	487	(13)	1746	(13)	1.19	(13)	20.1	(8)
Quiet	370	(28)	674	(28)	1.03	(28)	12.0	(28)
Sekulmun	497	(9)	1764	(9)	1.25	(9)	18.6	(9)
Snafu	685	(2)	7400	(2)	2.37	(2)	22.0	(1)
Twin (West)	354	(31)	1008	(31)	1.12	(31)	12.6	(26)
Wolf	495	(20)	1192	(25)	1.18	(20)	16.6	(19)

TABLE 16. Average length,weight,K and age of the least cisco catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Little Atlin	246	(1)	150	(1)	1.01	(1)	4.0	(1)
Little Salmon	309	(3)	333	(3)	1.13	(3)	4.0	(1)
Quiet	186	(34)	78	(34)	1.09	(34)	2.5	(33)
Snafu	214	(66)	124	(66)	1.25	(66)	2.5	(59)
Twin (West)	231	(32)	170	(32)	1.26	(32)	3.0	(30)

TABLE 17. Average length,weight,K and age of the broad whitefish catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Little Salmon	184	(5)	179	(5)	1.04	(5)	3.3	(3)
Michie	268	(4)	270	(4)	1.34	(4)	5.7	(3)
Snafu	311	(10)	310	(10)	1.03	(10)	7.3	(9)

The largest lake trout in terms of mean weight were found in Dezadeash, Michie and Coghlan Lakes (excluding those lakes with sample sizes < 10). Values for these lakes were 2.27 kg, 1.75 kg and 1.42 kg respectively (Table 15). Claire Lake produced trout with the lowest mean weight (0.45 kg).

A slightly different result was obtained with mean fork lengths where highest values were found in Dezadeash (537 mm), Wolf (495 mm) and Michie (487 mm) lakes. The lowest mean value, 313 mm, was recorded from Jojo Lake (Table 15).

The largest mean K-values for lake trout were obtained in Alligator (1.37), Coghlan (1.34) and Dezadeash Lakes (1.32) with the smallest found in Quiet (1.03).

Additional data regarding mean lengths, weights and condition factors determined by age class appears in Appendix D1.

On average, the heaviest northern pike were recorded in Claire ($\overline{X}$ = 2.24 kg), Twin (2.00 kg) and Little Atlin (1.93 kg). The same three lakes ranked highest in terms of both mean fork length and condition factor with mean values ranging from 571 mm to 618 mm and 0.85 to 1.00 respectively (Table 18). These K-values are overall higher than those reported (0.64-0.70) from some Northwest Territory pike populations (Falke and Gillman 1980). It is interesting that northern pike, the only species sampled in Taye Lake, were notably smaller and in poorer condition than those sampled in other lakes. The lack of other forage species combined with the reportedly occasional but heavy winter kill are factors which undoubtedly have significant bearing on these characteristics.

Additional data presenting means and ranges for each age class

TABLE 18. Average length,weight,K and age of the northern pike catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Big Kalzas	516	(3)	1087	(3)	0.76	(3)	6.0	(1)
Claire	618	(14)	2236	(14)	1.00	(14)	5.8	(14)
Dezadeash	726	(1)	3500	(1)	0.91	(1)	8.0	(1)
Ethel	670	(4)	2913	(4)	0.86	(4)	9.75	(4)
Fox	515	(6)	1047	(6)	0.74	(6)	6.2	(6)
Little Atlin	592	(30)	1927	(30)	0.85	(30)	9.2	(27)
Little Salmon	764	(1)	3500	(1)	0.78	(1)	8.0	(1)
Michie	594	(9)	1659	(9)	0.71	(9)	9.22	(9)
Snafu	541	(17)	1388	(17)	0.70	(17)	7.8	(16)
Taye	502	(22)	862	(22)	0.68	(22)	6.9	(22)
Twin (West)	571	(13)	2004	(13)	0.89	(13)	9.08	(13)
Wolf	674	(1)	2750	(1)	0.89	(1)	-	-

Table 19. Average length, weight, K and age of the Arctic grayling catch

TABLE 19. Average length,weight,K and age of the Arctic grayling catch.

LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Alligator	251	(140)	320	(140)	1.22	(140)	4.0	(102)
Big Kalzas	278	(1)	240	(1)	1.12	(1)	-	-
Claire	308	(51)	355	(51)	1.15	(51)	3.71	(48)
Ethel	299	(13)	431	(13)	1.22	(13)	3.4	(12)
Fox	255	(44)	309	(44)	2.11	(44)	2.8	(40)
Jojo	335	(23)	405	(23)	0.99	(23)	5.1	(18)
Quiet	223	(56)	211	(56)	1.15	(56)	2.3	(51)
Wolf	289	(32)	301	(33)	1.08	(32)	4.0	(26)

TABLE 20. Average length,weight,K and age of the burbot catch.

	STANDARD LENGTH (1)		WEIGHT		K (2)		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Big Kalzas	382	(5)	419	(5)	0.57	(5)	6.6	(5)
Fox	462	(2)	1038	(2)	0.82	(2)	11.5	(2)
Little Atlin	449	(12)	924	(12)	0.96	(12)	8.7	(12)
Michie	480	(4)	1014	(4)	0.67	(4)	9.0	(2)
Quiet	401	(13)	657	(13)	1.03	(13)	8.3	(10)
Sekulmun	377	(5)	512	(5)	0.69	(5)	7.0	(5)
Wolf	514	(1)	315	(1)	0.23	(1)	-	-

(1) Standard length used as fork length can not be measured on burbot

(2) K calculated using standard length

appears in Appendix D2.

Mean weights for Arctic grayling ranged from 0.21 kg to 0.43 kg with highest values occuring in Ethel (0.43 kg), Jojo (0.40 kg) and Claire (0.35 kg) lakes. The lowest value was obtained from the grayling in Quiet Lake.

In terms of mean fork length, the highest ranked lakes were Jojo (335 mm), Claire (308 mm), and Ethel (299 mm) lakes (Table 19).

The mean condition factor of 2.11 determined for Fox Lake grayling was significantly higher than those found in the other lakes in this study as well as values reported in other studies. For example, Falk et al. (1982) reported mean condition values ranging from 1.08 to 1.29 in Great Slave Lake and 1.25 and 1.54 in Providence Creek, N.W.T.

Mean values calculated by age class are recorded in Appendix D4.

Little Salmon Lake produced the highest values for humpback whitefish in terms of both mean weight and fork length, with respective values of 1.23 kg and 449 mm. Following close behind were fish from Wolf and Quiet Lakes with mean weights of 1.15 kg and 1.14 kg respectively (Table 21).

Mean condition (k) factors ranged from a low of 1.15 (Snafu) to a high of 1.51 (Twin). This range encompasses that reported by Moshenko and Low (1978), for Great Slave Lake.

Little Salmon Lake also produced on average, the largest least cisco with a mean weight of 0.33 kg and mean fork length of 309 mm. The condition factor, (k) ranged from 1.01 in Little Atlin to 1.26 in

TABLE 21. Average length,weight,K and age of the humpback whitefish catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Dezadeash	304	(86)	362	(86)	1.20	(86)	8.0	(69)
Ethel	411	(51)	1022	(51)	1.44	(51)	8.2	(38)
Fox	430	(65)	944	(65)	1.18	(65)	5.7	(63)
Little Atlin	332	(123)	681	(123)	1.33	(123)	6.2	(123)
Little Salmon	449	(34)	1226	(34)	1.34	(34)	8.6	(28)
Mayo	398	(45)	896	(48)	1.41	(45)	8.7	(23)
Michie	353	(63)	605	(63)	1.29	(63)	7.6	(54)
Quiet	429	(31)	1143	(31)	1.30	(31)	7.9	(26)
Snafu	336	(18)	443	(18)	1.15	(18)	8.2	(17)
Twin (West)	312	(64)	570	(64)	1.51	(64)	5.2	(61)
Wolf	431	(25)	1146	(25)	1.38	(25)	7.6	(21)

TABLE 22. Average length,weight,K and age of the round whitefish catch.

	FORK LENGTH		WEIGHT		K		AGE	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)	$\bar{X}$	(N)
Big Kalzas	393	(24)	696	(24)	1.10	(24)	7.65	(20)
Claire	326	(33)	420	(33)	1.10	(33)	5.03	(30)
Dezadeash	297	(40)	339	(40)	0.99	(40)	4.9	(29)
Ethel	280	(68)	261	(68)	1.02	(68)	4.3	(68)
Fox	323	(21)	381	(21)	1.67	(21)	5.6	(20)
Little Atlin	228	(25)	129	(25)	1.01	(25)	3.8	(25)
Little Salmon	397	(13)	662	(13)	1.06	(13)	7.6	(12)
Mayo	263	(18)	284	(20)	1.10	(18)	3.29	(17)
Quiet	291	(145)	271	(145)	0.98	(144)	4.3	(124)
Wolf	250	(94)	220	(94)	0.74	(104)	3.7	(86)

TABLE 23. Average length,weight,K and age of the longnose sucker catch.

	FORK LENGTH		WEIGHT		K	
LAKE	$\bar{X}$(mm)	(N)	$\bar{X}$(g)	(N)	$\bar{X}$	(N)
Big Kalzas	331	(2)	805	(2)	1.39	(2)
Dezadeash	445	(15)	1207	(10)	1.36	(10)
Little Atlin	441	(7)	1136	(7)	1.31	(7)

Twin Lake (Table 16).

Mean weights for round whitefish ranged from 0.13 kg in Little Atlin Lake to 0.69 kg in Big Kalzas Lake. A much lower range was recorded for mean lengths from 228 mm to 397 mm (Table 22). Fox Lake recorded the best condition value of 1.67, which was significantly higher than other values obtained during this study.

Comparisons of size for broad whitefish are limited to three lakes. Snafu Lake samples ranked highest in terms of mean weight and length; however, the condition factor (k) was lowest for this lake (Table 17).

Additional length, weight and condition data appears in Appendix D5 where values are presented by age class.

The number of lakes from which adequate samples of burbot were obtained is extremely limited. Of the two lakes where $n \geq 10$, Little Atlin was found to produce the greatest mean size both in terms of standard length and weight although burbot from Quiet Lake were slightly higher in terms of the mean condition factor (Table 20).

As with burbot, the sample of longnose sucker was too limited in both number and distribution to make any meaningful comparisons. The mean weights and lengths recorded in Dezadeash were overall the largest (1.21 kg and 445 mm respectively). No significant difference was apparent with regards to condition (Table 23).

4.6 Sex Composition and Maturity

The ratio between male and female fish in the catch was found to be disproportionate in the majority of the lakes and species examined. The anticipated one to one representation did not exist even among the largest sample sizes. For example, the ratio of male to female lake trout varied from 0.32:1 in Fox to 3.13:1 in Dezadeash Lake.

A summary of sex ratios is presented by species in Tables 24 to 30.

A maturity index similar to that employed in this study has been used elsewhere on a variety of species (Bond 1975; Moshenko and Low 1978; Falk and Gillman 1980). Presentation of results into the three catagories of "immature" (index 1), "maturing" (index 2) and "matured" (indicies 3 to 5) is the simplest approach when considering species that spawn in different seasons. The use of maturity data collected only during the summer months ensures consistency in the interpretation of gonadal development.

Age maturity of lake trout has been found to vary considerably over its North American range. Fry (1949) found lake trout maturing between four and seven years in lake Openogo,Ontario.In northern lake trout populations, Morrow (1980) reported females to range from 5 to 13 years, and Healey (1977) from 5 to 19 years for female lake trout to reach maturity. The latter goes on to state,however, that of the 17 populations examined 11 contained fish which first matured between five and seven years

The youngest "maturing" trout caught in Alligator Lake was seven years

TABLE 24. Sex ratios of the lake trout catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Alligator	82	(54.2)	71	(45.8)	0.87:1	19
Big Kalzas	13	(46.4)	15	(53.6)	1.15:1	6
Claire	24	(47.0)	27	(53.0)	1.13:1	9
Coghlan	9	(69.2)	4	(31.8)	0.44:1	0
Dezadeash	8	(24.2)	25	(75.8)	3.13:1	0
Ethel	9	(56.3)	7	(43.7)	0.78:1	0
Fox	19	(76.0)	6	(24.0)	0.32:1	1
Jojo	81	(59.1)	56	(41.9)	0.69:1	40
Little Atlin	3	(50.0)	3	(50.0)	1.00:1	0
Little Salmon	8	(33.3)	16	(66.7)	2.00:1	0
Mayo	1	(50.0)	1	(50.0)	1.00:1	0
Michie	5	(41.7)	7	(58.3)	1.40:1	1
Quiet	12	(42.9)	16	(57.1)	1.33:1	0
Sekulmun	3	(33.3)	6	(66.7)	2.00:1	0
Snafu	0	(0.0)	2	(100.0)	-	-
Twin (West)	11	(61.1)	7	(38.9)	0.64:1	12
Wolf	9	(45.0)	11	(55.0)	1.22:1	0

TABLE 25. Sex ratios of the Arctic grayling catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Alligator	39	(44.3)	49	(55.7)	1.26:1	52
Big Kalzas	1	(100.0)	0	-	-	-
Claire	15	(33.3)	30	(66.7)	2.00:1	6
Ethel	5	(45.4)	6	(54.6)	1.20:1	0
Fox	11	(40.7)	16	(59.3)	1.45:1	1
Jojo	14	(60.9)	9	(29.1)	0.64:1	0
Quiet	17	(54.8)	14	(45.2)	0.82:1	25
Wolf	15	(50.0)	15	(50.0)	1.00:1	3

TABLE 26. Sex ratios of the round whitefish catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Big Kalzas	11	(47.8)	12	(52.2)	1.09:1	1
Claire	14	(45.2)	17	(54.8)	1.21:1	2
Dezadeash	21	(58.3)	15	(41.7)	0.71:1	4
Ethel	30	(61.2)	19	(38.8)	0.63:1	0
Fox	6	(30.0)	14	(70.0)	2.33:1	1
Little Atlin	5	(71.4)	2	(28.6)	0.40:1	20
Little Salmon	9	(69.2)	4	(30.8)	0.44:1	0
Mayo	3	(27.3)	8	(72.7)	2.67:1	11
Quiet	63	(46.7)	72	(53.3)	1.78:1	10
Wolf	31	(57.4)	23	(42.6)	0.74:1	39

TABLE 27. Sex ratios of the burbot catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Big Kalzas	1	(33.3)	2	(66.7)	2.00:1	2
Fox	0	-	2	(100.0)	-	0
Little Atlin	3	(25.0)	9	(75.0)	3.00:1	0
Michie	0	-	3	(100.0)	-	1
Sekulmun	2	(40.0)	3	(60.0)	1.50:1	0
Wolf	0	-	1	(100.0)	-	0

TABLE 28. Sex ratios of the least cisco catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Little Atlin	0	-	1	(100.0)	-	0
Little Salmon	3	(100.0)	0	-	-	0
Quiet	12	(50.0)	12	(50.0)	1.00:1	10
Snafu	48	(72.7)	18	(27.3)	0.38:1	0
Twin (West)	11	(42.3)	15	(57.7)	1.36:1	6

TABLE 29. Sex ratios of the northern pike catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Big Kalzas	3	(100.0)	0	-	-	0
Claire	5	(38.4)	8	(61.6)	1.60:1	0
Dezadeash	0	-	1	(100.0)	-	0
Ethel	3	(75.0)	1	(25.0)	0.33:1	0
Fox	3	(50.0)	3	(50.0)	1.00:1	0
Little Atlin	10	(33.3)	20	(66.7)	2.00:1	0
Little Salmon	1	(100.0)	0	-	-	0
Michie	6	(66.7)	3	(33.3)	0.50:1	0
Snafu	4	(23.5)	13	(76.5)	3.25:1	0
Taye	7	(31.8)	15	(68.2)	2.14:1	0
Twin (West)	2	(16.7)	10	(83.3)	5.00:1	1
Wolf	1	(100.0)	0	-	-	0

TABLE 30. Sex ratios of the humpback whitefish catch.

LAKE	FEMALES N	(%)	MALES N	(%)	RATIO M : F	UNDETERMINED
Dezadeash	43	(55.8)	34	(44.2)	0.79:1	9
Ethel	31	(59.6)	21	(39.4)	0.68:1	0
Fox	31	(48.4)	33	(51.6)	1.06:1	1
Little Atlin	53	(50.0)	53	(50.0)	1.00:1	39
Little Salmon	20	(58.8)	14	(41.2)	0.70:1	0
Mayo	26	(57.8)	19	(42.2)	0.73:1	0
Michie	22	(36.1)	39	(63.9)	1.77:1	2
Quiet	13	(41.9)	18	(58.1)	1.38:1	0
Snafu	11	(61.1)	7	(38.9)	0.64:1	0
Twin (West)	27	(64.2)	15	(35.8)	0.56:1	22
Wolf	21	(84.0)	4	(16.0)	0.19:1	0

in Claire Lake, nine years, and in Jojo Lake, eight years. In all cases this preceded the appearance of the first mature samples by one or two years (Table 31). The youngest mature trout identified in the study was age seven from Dezadeash Lake. Further investigations may prove that individuals in this lake mature earlier.

The majority of the trout populations (more than 50%) in the five Yukon lakes presented in Table 31, were found to mature by age 11. This figure, used as an indicator of maturity trends in Yukon trout, is within the bounds reported in Alaska (Morrow 1980). It should be noted, however, that the five Yukon lakes used to predict general maturing tendencies were all selected for analysis due to their larger sample sizes, a possible reflection of abundant trout populations within the lakes. Further examination of lake trout maturity is required to determine if and how population density affects sexual development.

Mature lake trout may not spawn every year. This causes some confusion when trying to distinguish between a fish which is maturing and one which is mature but will not spawn in the current year. This latter classification was found to apply more frequently to fish between 9 and 13 years during studies in Ontario (Martin and Olver 1980). In the Yukon, this state appears to continue into later years while indications are that the larger, older fish eventually begin to spawn every year (Dept. of Fisheries in prep. B).

Difficulties in identification may also occur when confronted with the misleading characteristics of female trout spawning for the

TABLE 31. Proportional representation of maturation stages in lake trout.

	ALLIGATOR				BIG KALZAS				CLAIRE			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
4	0				2	100.0	-	-	0			
5	0				3	33.0	67.0	-	1	100.0	-	-
6	1	100.0	-	-	0				7	100.0	-	-
7	2	50.0	50.0	-	1	100.0	-	-	6	100.0	-	-
8	5	20.0	60.0	20.0	1	-	100.0	-	6	100.0	-	-
9	9	11.0	44.5	44.5	1	-	100.0	-	3	33.0	17.0	-
10	11	-	27.0	73.0	1	-	100.0	-	4	75.0	-	25.0
11	4	-	-	100.0	3	-	100.0	-	5	60.0	20.0	20.0
12	4	-	-	100.0	6	17.0	83.0	-	3	-	67.0	33.0
13	3	-	-	100.0	2	-	100.0	-	3	-	67.0	33.0
14	6	-	17.0	83.0	3	33.0	67.0	-	3	-	33.0	67.0
15	4	-	-	100.0	5	20.0	40.0	40.0	0			
16	1	-	-	100.0	2	-	50.0	50.0	1	-	100.0	-
17	2	-	-	100.0	1	-	100.0	-	1	-	-	100.0
18	3	-	33.0	67.0	4	-	25.0	75.0	0			
19	5	-	20.0	80.0	5	-	60.0	40.0	0			
20	3	-	33.0	67.0	2	50.0	-	50.0	0			
21	4	-	-	100.0	1	-	100.0	-	0			
22	2	-	50.0	50.0	3	-	33.0	67.0	0			
23	4	-	-	100.0	0				0			
24	2	-	-	100.0	0				0			
25	3	-	67.0	33.0	1	100.0	-	-	0			
26	0				1	-	100.0	-	0			
27	2	-	-	100.0	0				0			
28	0				0				0			
29	1	100.0	-	-	0				0			
30	2	-	50.0	50.0	0				0			
31	0				0				0			
TOTAL	83	6.0	23.0	71.0	48	19.0	58.0	23.0	43	65.0	19.0	16.0

	DEZADEASH				JOJO				ALL LAKES			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
4	0				0				2	100.0	-	-
5	0				0				4	100.0	-	-
6	0				1	100.0	-	-	8	100.0	-	-
7	1	-	-	100.0	4	100.0	-	-	14	86.0	7.0	7.0
8	1	-	-	100.0	3	33.0	67.0	-	16	50.0	38.0	12.0
9	5	-	20.0	80.0	4	-	100.0	-	22	9.0	55.0	36.0
10	1	-	-	100.0	8	38.0	50.0	12.0	25	24.0	32.0	44.0
11	3	-	-	100.0	9	-	44.0	56.0	24	13.0	33.0	54.0
12	0				13	-	38.0	62.0	26	4.0	46.0	50.0
13	0				12	-	42.0	58.0	20	-	45.0	55.0
14	0				6	-	50.0	50.0	18	5.0	39.0	56.0
15	4	-	-	100.0	9	-	44.0	56.0	22	5.0	27.0	68.0
16	2	-	-	100.0	3	-	-	100.0	9	-	22.0	78.0
17	3	-	-	100.0	5	-	40.0	60.0	12	-	25.0	75.0
18	2	-	-	100.0	2	-	-	100.0	11	-	18.0	82.0
19	1	-	-	100.0	6	-	17.0	83.0	17	-	29.0	71.0
20	2	-	-	100.0	3	-	-	100.0	10	10.0	10.0	80.0
21	2	-	-	100.0	4	-	-	100.0	11	-	9.0	91.0
22	2	-	-	100.0	2	-	-	100.0	9	-	22.0	78.0
23	0				3	-	-	100.0	7	-	-	100.0
24	0				2	-	-	100.0	4	-	-	100.0
25	0				0				4	25.0	50.0	25.0
26	1	-	-	100.0	1	-	-	100.0	3	-	33.0	67.0
27	1	-	-	100.0	1	-	-	100.0	4	-	-	100.0
28	1	-	-	100.0	0				1	-	-	100.0
29	0				1	-	-	100.0	2	-	-	100.0
30	0				1	-	-	100.0	3	-	25.0	75.0
31	0				1	-	-	100.0	1	-	-	100.0
TOTAL	32		3.0	97.0	104	9.0	32.0	59.0	309	16.0	29.0	55.0

first time. The size and shape of the ova may not be interpreted as mature which would then lead to its designation into the "maturing" category (Martin and Olver 1980).

Although small sample sizes do not provide sufficient information for a conclusive lake to lake comparison, the overall trend in humpback whitefish maturity in the Yukon can be seen when all areas are combined (Table 32). Fish were found to begin maturing in their fourth year, with the majority of the populations reaching maturity between the ages of 7 and 10 years. This is slightly higher than ages of first maturity compiled by Healey (1977) for 13 unexploited whitefish populations.

Although insufficient data eliminates the possibility of drawing any conclusions about maturity in least cisco, some trends can be noted (Table 33). Fish began maturing in their second year with some reaching maturity at age three.The majority of the populations matured between three and four years,which is consistent with the findings among Alaskan least cisco (Morrow 1980).

Arctic grayling were found in the maturing stages in their second year with the majority of the populations reaching maturity by age five. This is in agreement with findings from the Northwest Territories where grayling were maturing between five and six years (Falk and Gillman 1980). The records of "maturing" fish in Alligator Lake among the upper age classes (Table 34) can likely be attributed to the misinterpretation of the presence of small, residual eggs in spawning out females.

TABLE 32. Proportional representation of maturation stages in humpback whitefish.

	DEZADEASH				ETHEL				FOX				LITTLE ATLIN			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	0				0				0				8	100.0	-	-
2	0				0				0				4	100.0	-	-
3	2	-	100.0	-	0				0				0			
4	8	62.0	38.0	-	0				5	20.0	40.0	40.0	0			
5	15	27.0	46.0	27.0	3	-	33.0	67.0	24	-	29.0	71.0	0			
6	8	-	50.0	50.0	6	-	67.0	33.0	19	-	26.0	74.0	2	-	50.0	
7	10	-	50.0	50.0	6	-	50.0	50.0	6	-	17.0	83.0	12	8.0	17.0	75.0
8	5	20.0	20.0	60.0	4	-	-	100.0	4	-	25.0	75.0	17	-	35.0	
9	4	-	100.0	-	8	-	25.0	75.0	1	-	-	100.0	5	-	20.0	
10	1	-	-	100.0	8	-	25.0	75.0	0				4	-	75.0	25.0
11	2	-	100.0	-	3	-	33.0	67.0	0				2	-	-	100.0
12	0				0				0				2	-	-	100.0
TOTAL	55	18.0	51.0	31.0	39		33.0	67.0	59	2.0	27.0	71.0	56	23.0	23.0	54.0

	LITTLE SALMON				MAYO				MICHIE				SNAFU			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATUR
1	0				0				0				0			
2	0				0				0				0			
3	0				0				0				0			
4	0				0				2	-	100.0	-	0			
5	0				5	-	100.0	-	0				1	-	100.0	-
6	0				1	-	-	100.0	3	-	100.0	-	1	-	100.0	-
7	3	-	33.0	67.0	1	-	-	100.0	5	-	100.0	-	2	-	-	100.0
8	10	-	60.0	40.0	8	-	25.0	75.0	13	-	38.0	62.0	7	-	86.0	14.0
9	3	-	67.0	33.0	7	-	14.0	86.0	2	-	50.0	50.0	3	-	33.0	67.0
10	4	-	50.0	50.0	2	-	-	100.0	4	-	50.0	50.0	2	-	50.0	50.0
11	1	-	-	100.0	2	-	-	100.0	0				1	-	-	100.0
12	0				1	-	-	100.0	1	-	-	100.0	0			
TOTAL	21		52.0	48.0	27		30.0	70.0	30		60.0	40.0	17		59.0	41.0

	TWIN				WOLF				ALL LAKES			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	0				0				8	100.0	-	-
2	0				0				4	100.0	-	-
3	0				0				2	-	100.0	-
4	0				1	-	-	100.0	16	38.0	44.0	18.0
5	0				1	-	-	100.0	49	8.0	43.0	49.0
6	3	-	67.0	33.0	1	-	100.0	-	44	-	48.0	52.0
7	3	-	-	100.0	8	25.0	63.0	12.0	64	5.0	38.0	57.0
8	2	-	-	100.0	5	-	100.0	-	74	1.0	42.0	57.0
9	1	-	-	100.0	3	-	67.0	33.0	32	-	40.0	63.0
10	2	-	-	100.0	0				27	-	37.0	63.0
11	1	-	-	100.0	2	-	50.0	50.0	14	-	29.0	71.0
12	0				0				4	-	-	100.0
TOTAL	12		17.0	83.0	21	10.0	66.0	24.0	338	8.0	39.0	53.0

TABLE 33. Proportional representation of maturation stages in least cisco.

	QUIET				SNAFU				TWIN				ALL LAKES			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	9	100.0	-	-	0				1	100.0	-	-	10	100.0	-	-
2	15	-	100.0	-	31	-	100.0	-	4	25.0	75.0	-	50	2.0	98.0	-
3	3	33.0	67.0	-	25	-	96.0	4.0	8	-	25.0	75.0	36	3.0	78.0	19.0
4	0				2	-	100.0	-	5	-	-	100.0	7	-	29.0	71.0
5	0				0				5	-	20.0	80.0	5	-	20.0	80.0
TOTAL	27	37.0	63.0		58		98.0	2.0	23	9.0	26.0	65.0	108	11.0	74.0	15.0

TABLE 34. Proportional representation of maturation stages in Arctic grayling.

	ALLIGATOR				CLAIRE				ETHEL				JOJO			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	25	100.0	-	-	2	100.0	-	-	2	100.0	-	-	0			
2	18	33.0	67.0	-	5	100.0	-	-	3	-	67.0	33.0	0			
3	16	63.0	37.0	-	2	50.0	50.0	-	0				3	-	100.0	-
4	4	-	-	100.0	30	37.0	43.0	20.0	1	-	100.0	-	1	-	-	100.0
5	14	-	14.0	86.0	7	14.0	29.0	57.0	1	-	-	100.0	9	-	22.0	78.0
6	12	-	17.0	83.0	0				2	-	50.0	50.0	3	-	-	100.0
7	8	-	12.0	88.0	0				1	-	100.0	-	1	-	-	100.0
8	3	-	33.0	67.0	0				0				1	-	-	100.0
TOTAL	100	41.0	24.0	35.0	46	43.0	35.0	22.0	10	20.0	50.0	30.0	18		28.0	72.0

	QUIET				WOLF				ALL LAKES			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	30	100.0	-	-	2	100.0	-	-	61	100.0	-	-
2	0				2	50.0	50.0	-	28	43.0	54.0	3.0
3	6	33.0	67.0	-	7	43.0	43.0	14.0	34	47.0	50.0	3.0
4	9	33.0	67.0	-	6	-	83.0	17.0	51	27.0	49.0	24.0
5	5	-	100.0	-	2	-	-	100.0	38	3.0	29.0	68.0
6	1	100.0	-	-	3	-	67.0	33.0	21	5.0	24.0	71.0
7	0				2	-	-	100.0	12	-	17.0	83.0
8	0				1	-	-	100.0	5	-	20.0	80.0
TOTAL	51	71.0	29.0		25	24.0	44.0	32.0	250	42.0	31.0	27.0

TABLE 35. Proportional representation of maturation stages in round whitefish.

	BIG KALZAS				CLAIRE				DEZADEASH				ETHEL			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	0				1	100.0	-	-	0				2	100.0	-	-
2	0				2	50.0	50.0	-	0				7	100.0	-	-
3	1	100.0	-	-	4	100.0	-	-	2	50.0	50.0	-	5	60.0	40.0	-
4	1	100.0	-	-	7	71.0	29.0	-	12	33.0	50.0	17.0	20	25.0	60.0	15.0
5	2	50.0	-	50.0	4	-	25.0	75.0	6	17.0	33.0	50.0	9	12.0	44.0	44.0
6	1	-	100.0	-	4	50.0	-	50.0	4	-	50.0	50.0	10	-	90.0	10.0
7	4	-	100.0	-	4	-	25.0	75.0	0				9	22.0	45.0	33.0
8	4	-	50.0	50.0	0				2	-	50.0	50.0	2	-	50.0	50.0
9	5	-	60.0	40.0	2	-	50.0	50.0	0				0			
10	3	-	33.0	67.0	1	-	-	100.0	0				0			
TOTAL	21	14.0	53.0	33.0	29	45.0	21.0	34.0	26	23.0	46.0	31.0	64	31.0	50.0	19.0

	FOX				QUIET				WOLF				ALL LAKES			
AGE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE	N	% IMMATURE	% MATURING	% MATURE
1	0				12	75.0	25.0	-	32	100.0	-	-	27	89.0	11.0	-
2	1	100.0	-	-	6	-	100.0	-	3	67.0	33.0	-	20	60.0	40.0	-
3	0				17	6.0	88.0	6.0	3	-	100.0	-	25	40.0	56.0	4.0
4	2	50.0	50.0	-	24	4.0	83.0	13.0	4	-	100.0	-	71	25.0	63.0	15.0
5	3	-	-	100.0	23	-	70.0	30.0	8	25.0	25.0	50.0	57	9.0	47.0	44.0
6	11	-	9.0	91.0	16	-	19.0	81.0	16	6.0	13.0	81.0	64	5.0	30.0	65.0
7	3	-	67.0	33.0	8	-	13.0	87.0	8	-	13.0	87.0	37	5.0	35.0	60.0
8	0				2	-	-	100.0	5	-	20.0	80.0	17	-	29.0	71.0
9	0				0				0				7	-	57.0	43.0
10	0				0				0				4	-	25.0	75.0
TOTAL	20	10.0	20.0	70.0	108	10.0	59.0	31.0	79	47.0	18.0	35.0	329	22.0	42.0	36.0

Round whitefish have been reported to mature by age five in the southern parts of their range (Morrow 1980) and age seven in northern Alaska (Furniss 1974). Yukon fish were found to begin maturing in some lakes as early as two years with the majority of the population mature by age six (Table 35).

4.7 Fecundity

Egg counts as determined for lake trout are presented in Table 36 along with number of eggs per kg and mean diameter. The largest count was 15,188 eggs and the smallest was 453 eggs. The mean fecundity overall was 1,948.

Within the same age class, egg counts were found to vary considerably. For example, for 10 year old trout from Alligator Lake. counts varied from 1367 to 2950 eggs while in Jojo Lake fecundities for age 12 trout ranged from 543 to 1035.

Low sample sizes precluded extensive comparison between lakes. In the three lakes where $n > 10$, mean fecundities compared as follows: Jojo, 854 (n=28); Claire, 1558 (n=13); and Alligator, 2167 (n=33). To examine trends in fecundity with increasing size for each of these lakes, mean values were calculated for specified length and weight intervals and graphed accordingly (Figure 3). Although the results are somewhat undefined by the lack of data points, both Jojo and Claire Lake trout generally show an increase in fecundity with size, a trend similar to that reported by Martin and Olver (1980).

Lake trout is Alligator Lake displayed another interesting trend. Fecundity increased with size to a point after which values appeared to actually decrease (Figure 3). The implication here is that the

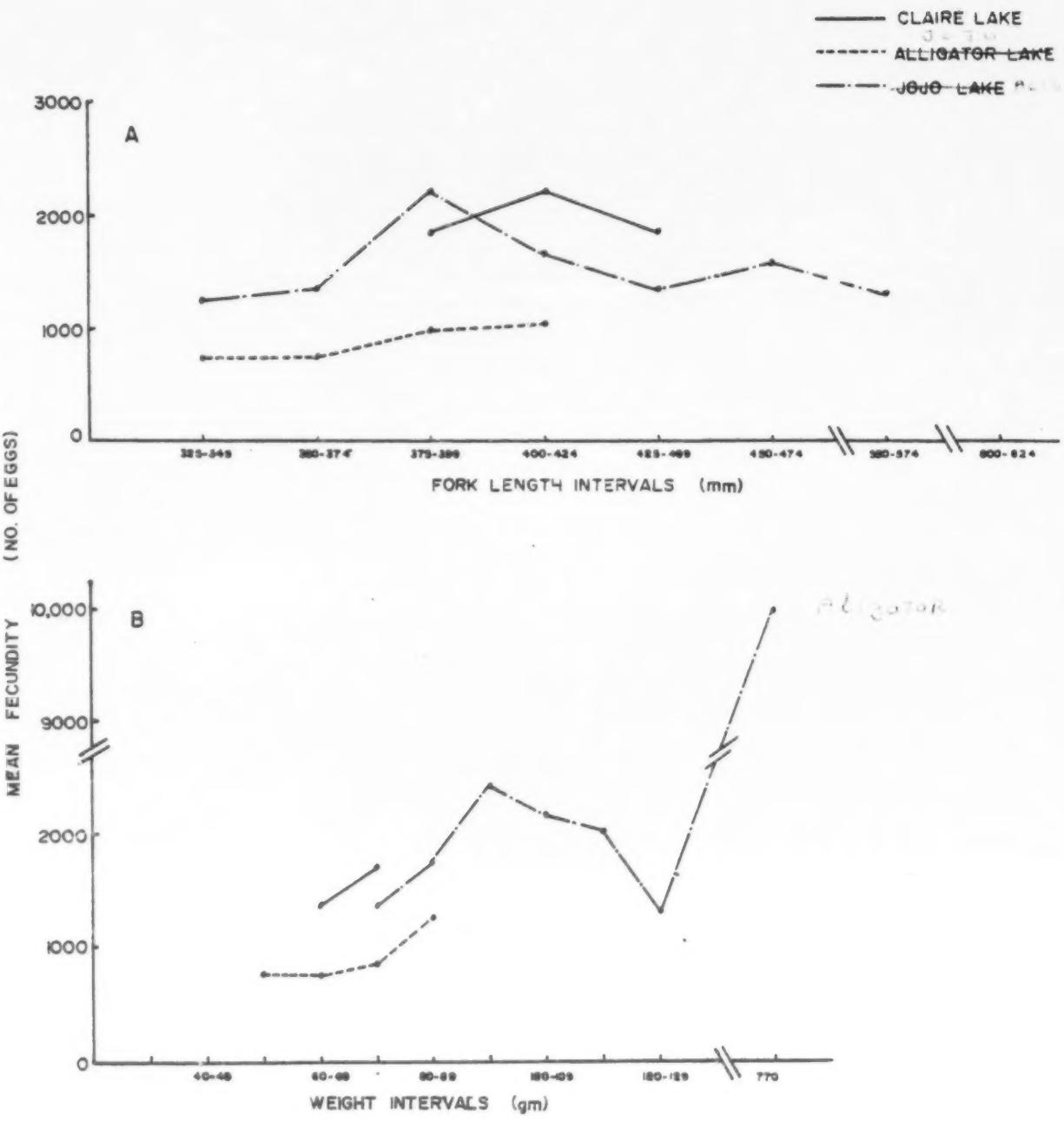


FIG.3. A comparison of fecundity: size relationships in lake trout from Alligator, Claire and Jojo Lakes, Yukon Territory 1982-83. (A) mean fecundity vs. fork length intervals; (B) mean fecundity vs. weight intervals.

TABLE 36. Lake trout fecundity.

LAKE	AGE	FORK LENGTH (mm)	WEIGHT (kg)	# EGGS	# EGGS per kg	MEAN SIZE OF EGGS (mm)
BIG KALZAS	12	404	0.62	2623	4230	1.7
	15	458	1.10	3179	2890	1.5
	16	470	1.26	1776	1409	4.3
	22	497	1.15	4473	3889	1.5
	26	455	1.12	2915	2602	1.3
	-	483	1.23	1764	1434	1.5
CLAIRE	9	394	0.75	2408	3210	1.0
	10	361	0.51	1219	2390	1.6
	11	373	0.65	1502	2310	3.6
	11	374	0.64	709	1107	3.0
	11	365	0.60	1955	3258	1.7
	12	471	-	1567	-	1.2
	12	337	0.70	1244	1777	3.5
	13	436	0.89	1368	1537	3.3
	13	388	0.74	1992	2691	3.7
	14	401	0.77	1261	1637	4.2
	14	404	0.74	1176	1589	3.2
	14	407	0.72	2550	3541	1.7
	16	572	1.00	1303	1303	1.2
QUIET	13	431	0.80	1394	1742	1.1
	15	437	1.00	1229	1229	3.5
WOLF	23	500	1.46	1268	868	4.7
	28	688	4.40	6768	1538	1.5
	-	554	1.98	1805	911	4.9
FOX	14	423	0.95	1865	1963	-
	21	725	5.67	15188	2678	-
	26	483	1.31	3371	2573	-
TWIN WEST	17	614	3.30	7866	2383	-
JOJO	11	362	0.60	718	1196	-
	11	342	0.50	952	1904	-
	11	389	0.75	1023	1364	-
	12	360	0.50	640	1280	-
	12	360	0.65	1035	1592	-
	12	353	0.60	543	905	-
	12	350	0.65	632	972	-
	12	382	0.72	1230	1708	-
	13	384	0.65	840	1292	-
	13	370	0.55	676	1229	-
	13	405	0.72	444	616	-
	14	382	0.70	875	1250	-
	14	353	0.57	821	1440	-
	15	386	0.55	1400	2545	-
	15	364	0.65	632	972	-
	16	371	0.72	747	1037	-
	17	380	0.70	937	1338	-
	18	393	0.70	933	1332	-
	19	344	0.50	521	1042	-
	19	370	0.70	739	1055	-
	21	338	0.40	700	1750	-
	24	400	0.70	882	1260	-
	26	375	0.60	869	1448	-
	-	379	0.55	453	823	-
	-	414	0.85	1255	1476	-
	-	421	0.95	1083	1140	-
	-	366	0.68	815	1198	-
	-	400	0.93	1507	1620	-

Table 36 . Continued

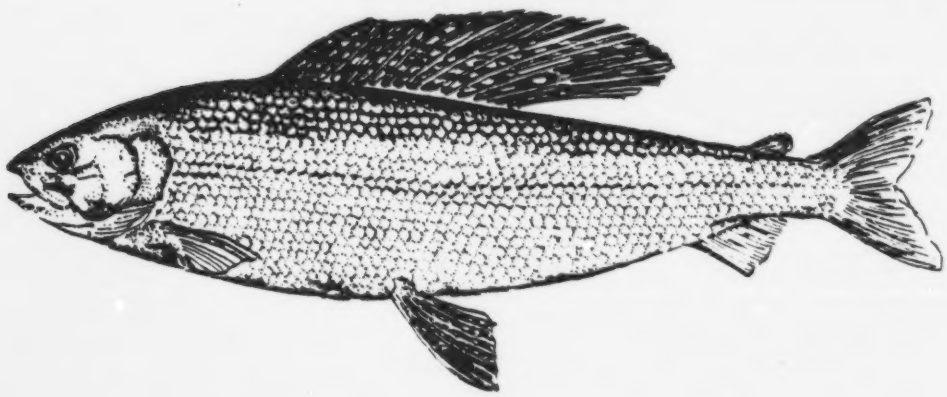
LAKE	AGE	FORK LENGTH (mm)	WEIGHT (kg)	# EGGS	# EGGS per kg	MEAN SIZE OF EGGS (mm)
ALLIGATOR	9	432	1.30	1369	1053	-
	10	385	0.85	1552	1825	-
	10	393	0.80	2950	3687	-
	10	402	0.80	1465	1831	-
	10	394	0.80	1367	1708	-
	10	425	1.20	1673	1394	-
	10	410	1.00	1401	1401	-
	11	405	0.90	2159	2398	-
	12	409	1.10	1392	1265	-
	12	386	0.72	1166	1608	-
	14	406	1.00	1622	1622	-
	14	382	0.82	1276	1556	-
	15	399	0.90	1729	1921	-
	19	402	0.90	4933	5481	-
	19	393	0.85	1246	1465	-
	21	438	0.85	1776	2089	-
	22	430	1.03	454	440	-
	22	406	0.90	1735	1927	-
	23	430	1.10	1710	1554	-
	23	443	0.90	1515	1683	-
	24	426	1.05	1578	1502	-
	24	423	1.05	1601	1524	-
	25	446	1.25	1715	1143	-
	30	452	1.20	561	467	-
	36	802	7.70	9825	1275	-
	-	425	1.00	788	788	-
	-	442	1.05	5725	5452	-
	-	411	0.85	2900	3411	-
	-	415	1.10	884	803	-
	-	393	1.10	4200	3818	-
	-	400	1.05	4150	3952	-
	-	389	0.85	1528	1797	-
	-	387	0.70	1560	2228	-
LITTLE SALMON	21	398	0.60	1600	2666	-
	-	490	1.50	2276	1517	-
ETHEL	15	424	1.00	792	792	-
	20	455	1.25	1454	1163	-
	21	436	1.17	5250	4487	-
	21	454	1.30	1427	1097	-
	22	473	1.30	1840	1415	-
	25	439	1.20	1167	972	-

optimum egg production does not necessarily correspond to the large size fish; intermediate-sized females may have greater reproductive potential. Further investigation is required to substantiate this, as only one large female containing 9825 eggs and weighing 7.7 kg was sampled in Alligator Lake.

The occurence of three sizes of ova, especially prominent among individuals with ripe gonads, was not uncommon. The largest eggs are believed to be those to be spawned in the current year; the intermediate ones the following year; and the smallest, the third year (Martin and Clver 1980).

The mean diameter of eggs varied from 1.0 mm to 4.9 mm. This average size was not related to fish dimensions, but rather to its state of spawning development. As all measured egg samples were obtained within the same three week period, any seasonal variability was reduced.

The youngest lake trout age class from which developing eggs were obtained was nine years (Table 36). This is a direct reflection on the age of first maturity as discussed in Section 4.6.



ARCTIC GRAYLING *Thymallus arcticus*

4.8 Growth Rates

Investigations conducted during this study showed significant differences between the growth rates of some species when compared by lake.

The first method utilized to describe and assess these differences involved the creation of figures displaying the relationship between age and the mean weight of the samples within each age class. These results are presented in Figures 4 through 26. Also shown is the calculated 95% confidence interval for each mean weight and the sample size available for each calculation.

On examining lake trout, extreme variation in weight was frequently encountered within specific age classes. When combined with relatively small sample sizes ($N < 10$ within each age class) this tended to produce very wide confidence intervals. For example, 18 year old lake trout in Jojo Lake (n=3) ranged in weight from 0.6 to 1.5 kg (Appendix D1) with the resulting 95% confidence interval encompassing values from 0.1 kg to 2.1 kg (Fig. 4).

Lakes found to have the most diverse age composition within the trout catch were Jojo and Alligator in which 26 and 25 respective age classes were identified. In both cases, substantial overlap in age classes with respect to size occurred after twelve years of age (Fig.4 and 8).

The weight-age relationship for Arctic grayling in seven lakes is illustrated in Figures 12 through 15. A good representation of a number of age classes was obtained for grayling in Alligator Lake, which when graphed, displayed a sigmoid growth rate (Fig. 12B). A similar trend is apparent for Wolf Lake grayling (Fig. 14B). Small

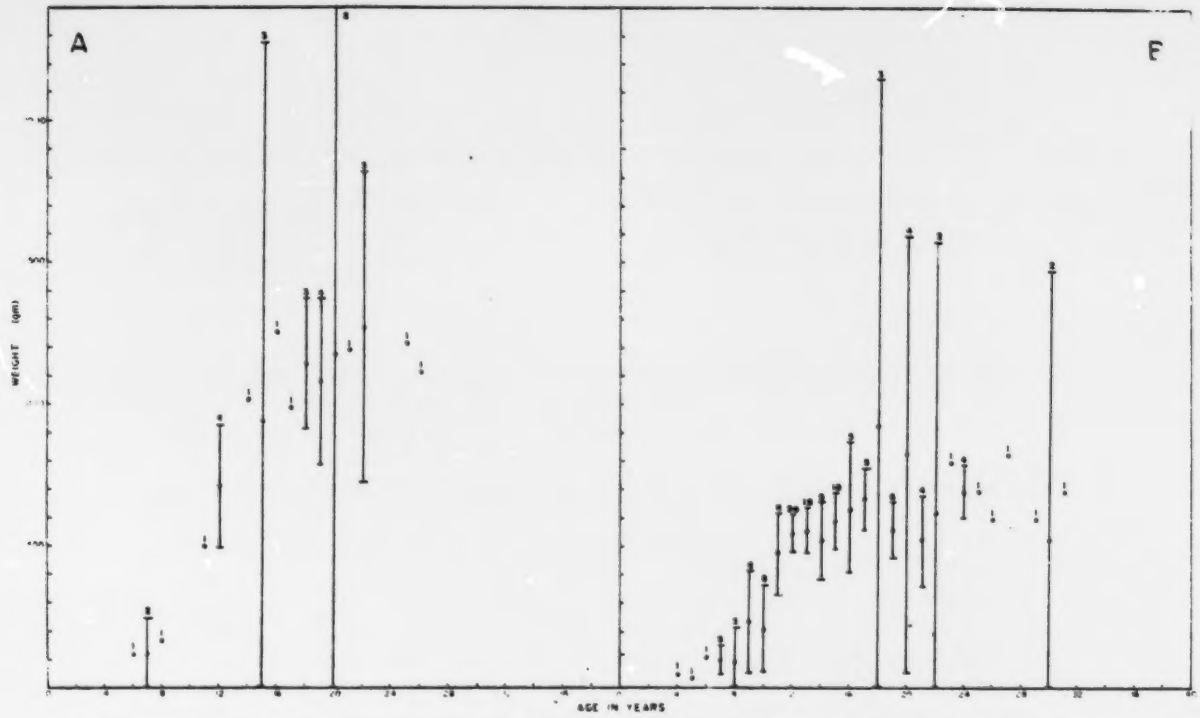


FIG. 4. Average growth rates of lake trout from: A) Big Kalzas Lake and B) Jojo Lake showing 95% confidence intervals and sample sizes.

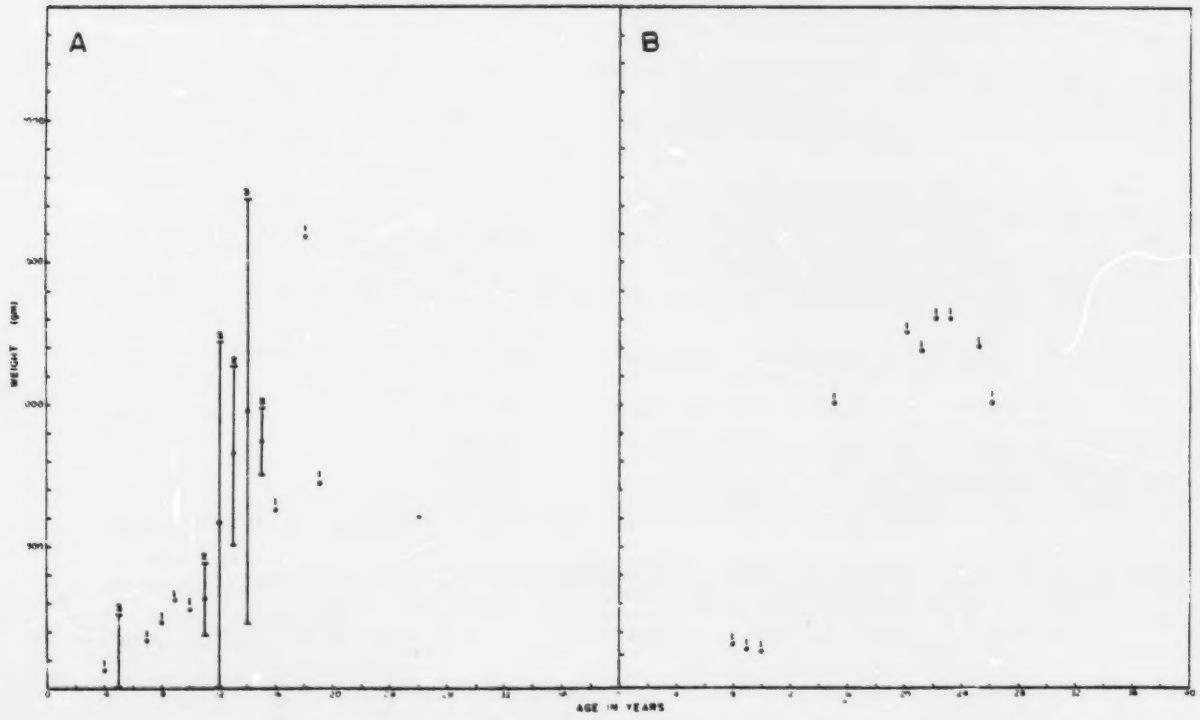


FIG. 5. Average growth rates of lake trout from: A) Quiet Lake and B) Ethel Lake showing 95% confidence intervals and sample sizes.

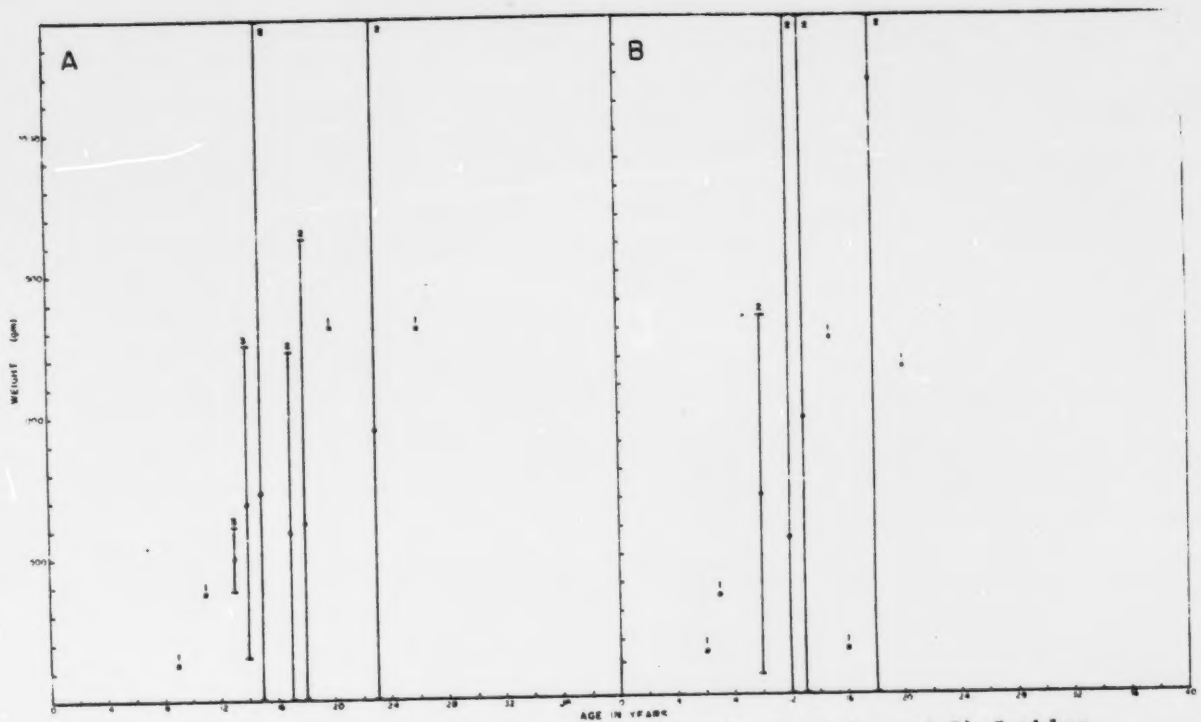


FIG. 6. Average growth rates of lake trout from:A) Fox Lake and B) Coghlan Lake showing 95% confidence intervals and sample sizes.

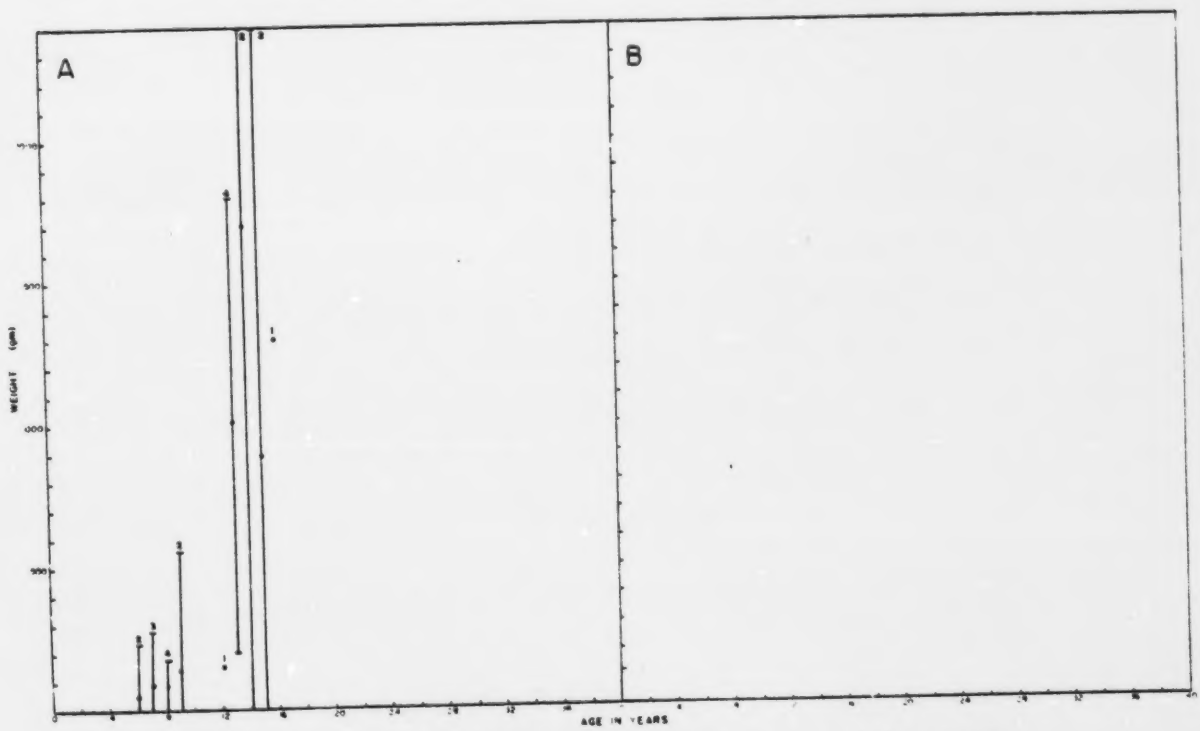


FIG. 7. Average growth rates of lake trout from:A) Twin Lake showing 95% confidence intervals and sample sizes.

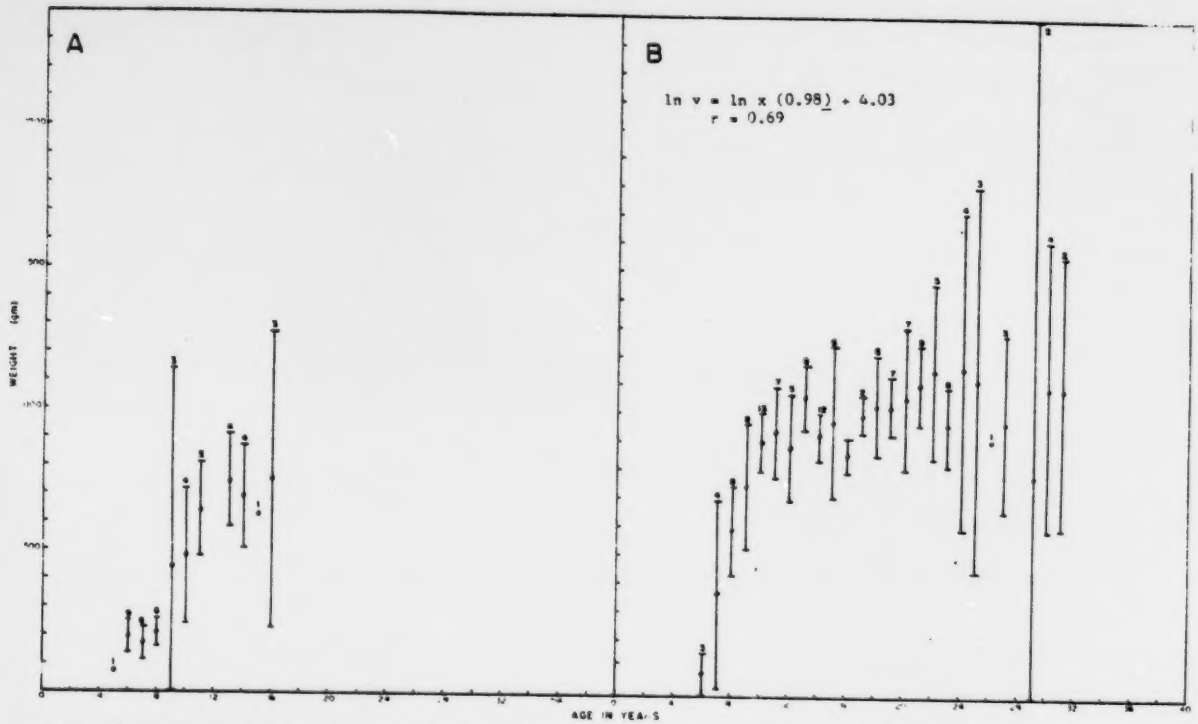


FIG. 8. Average growth rates of lake trout from: A) Claire Lake and B) Alligator Lake showing 95% confidence intervals and sample sizes.

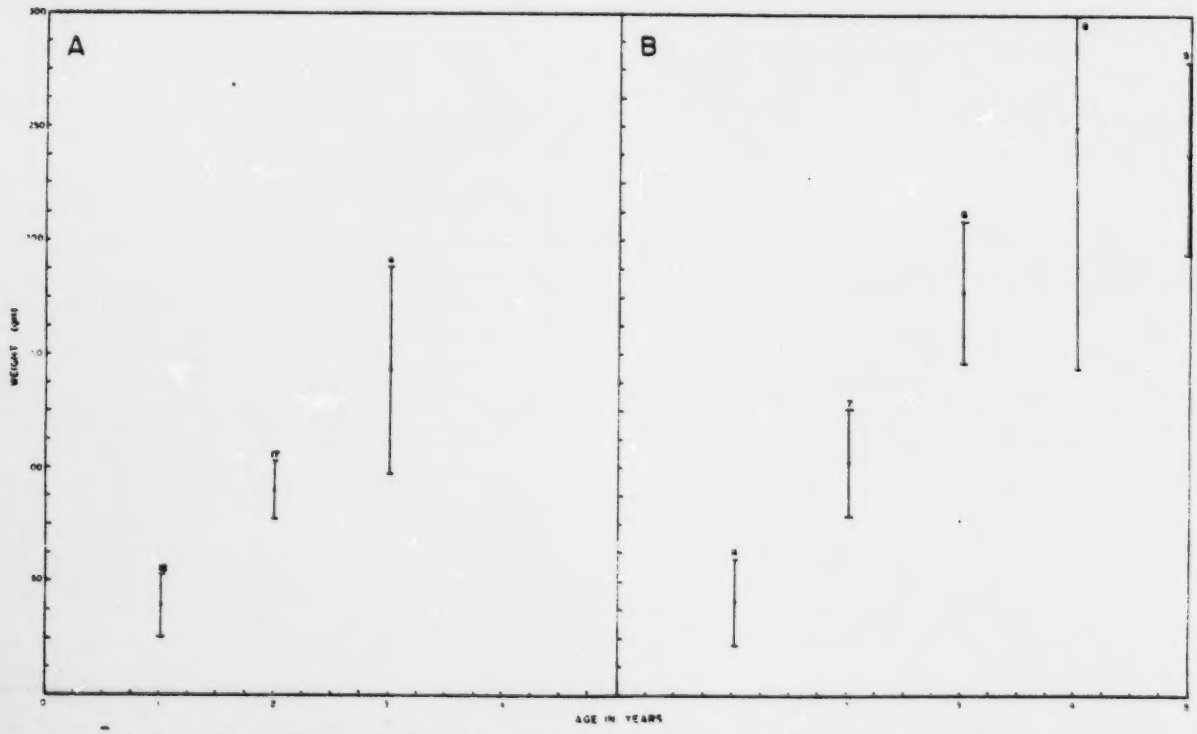


FIG. 9. Average growth rates of least cisco from: A) Quiet Lake and B) Twin Lake showing 95% confidence intervals and sample sizes.

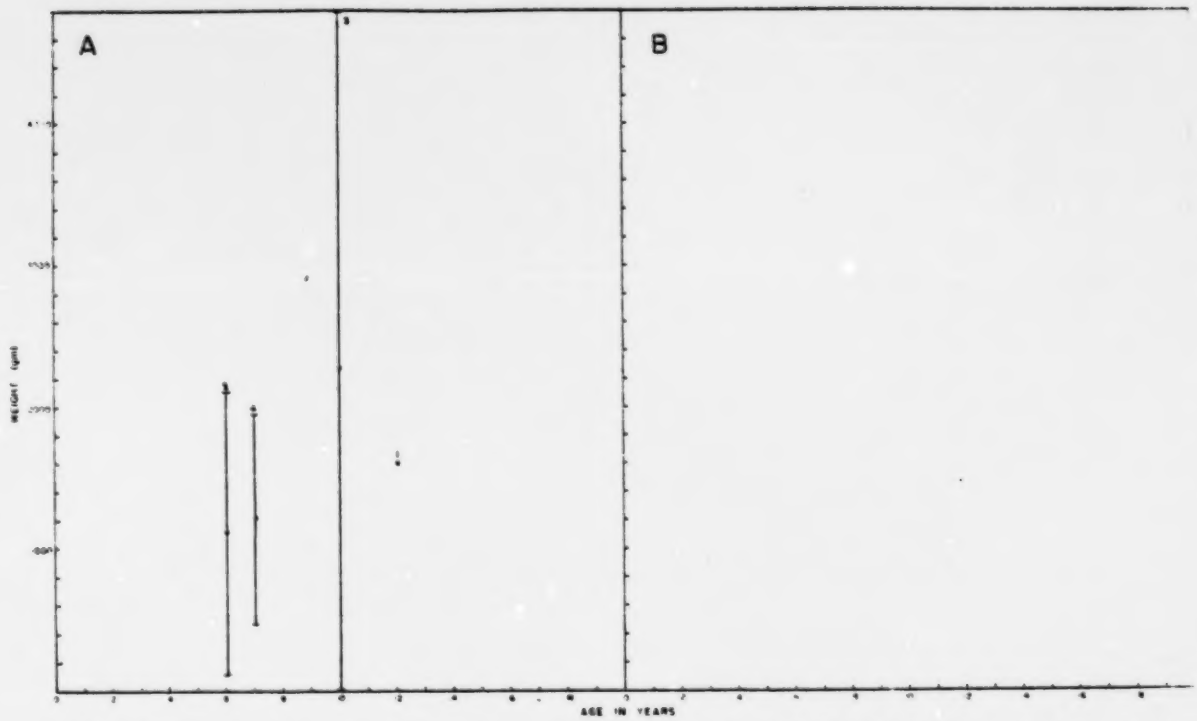


FIG. 10. Average growth rates of northern pike from:A) Snafu Lake showing 95% confidence intervals and sample sizes.

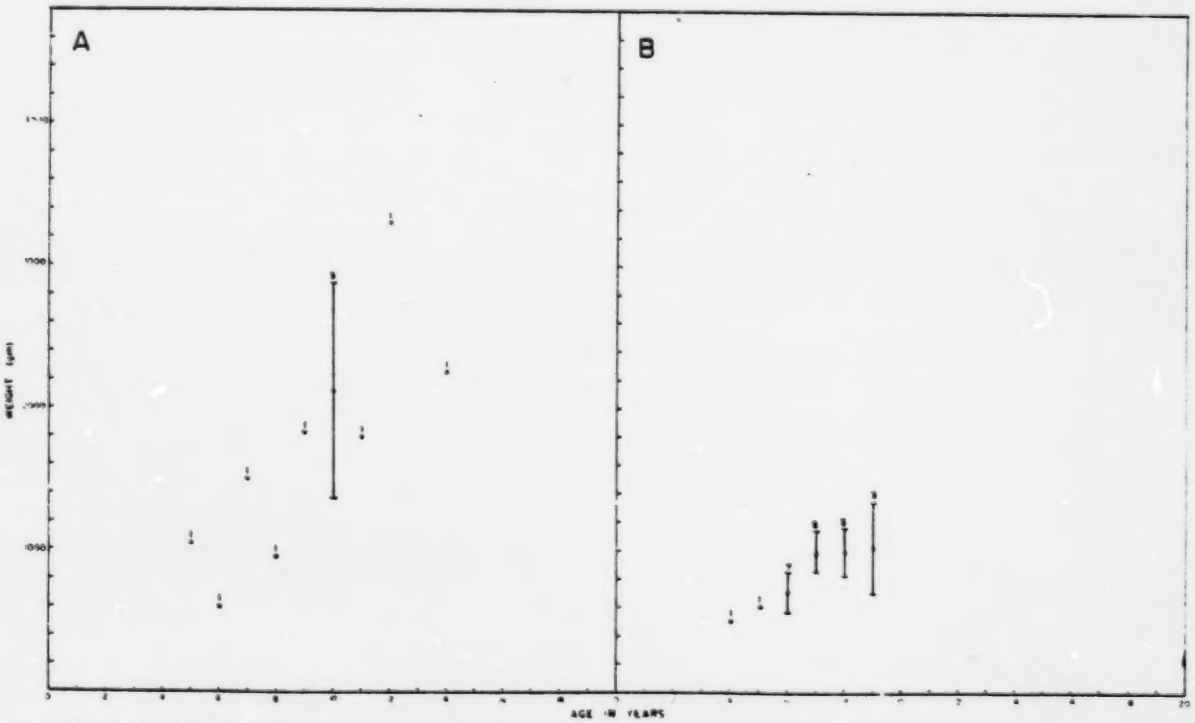


FIG. 11. Average growth rates of northern pike from:A) Twin Lake and B) Taye Lake showing 95% confidence intervals and sample sizes.

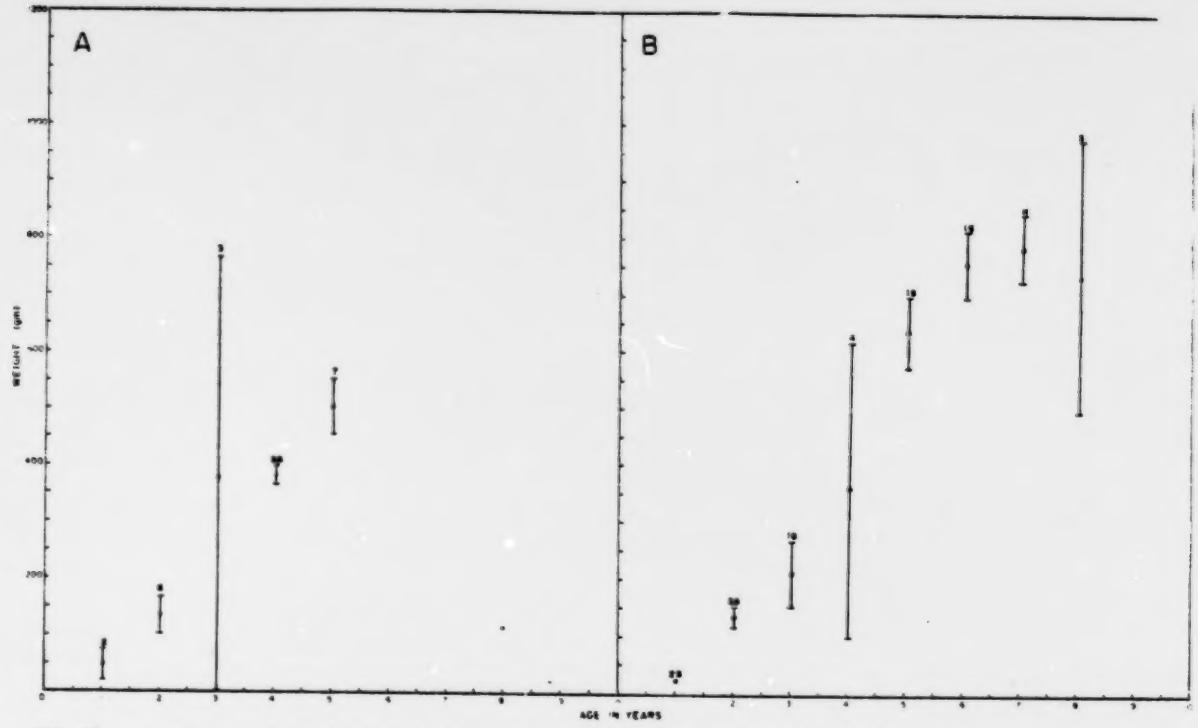


FIG. 12 Average growth rates of Arctic grayling from A) Claire lake and B) Alligator lake showing 95% confidence intervals and sample sizes.

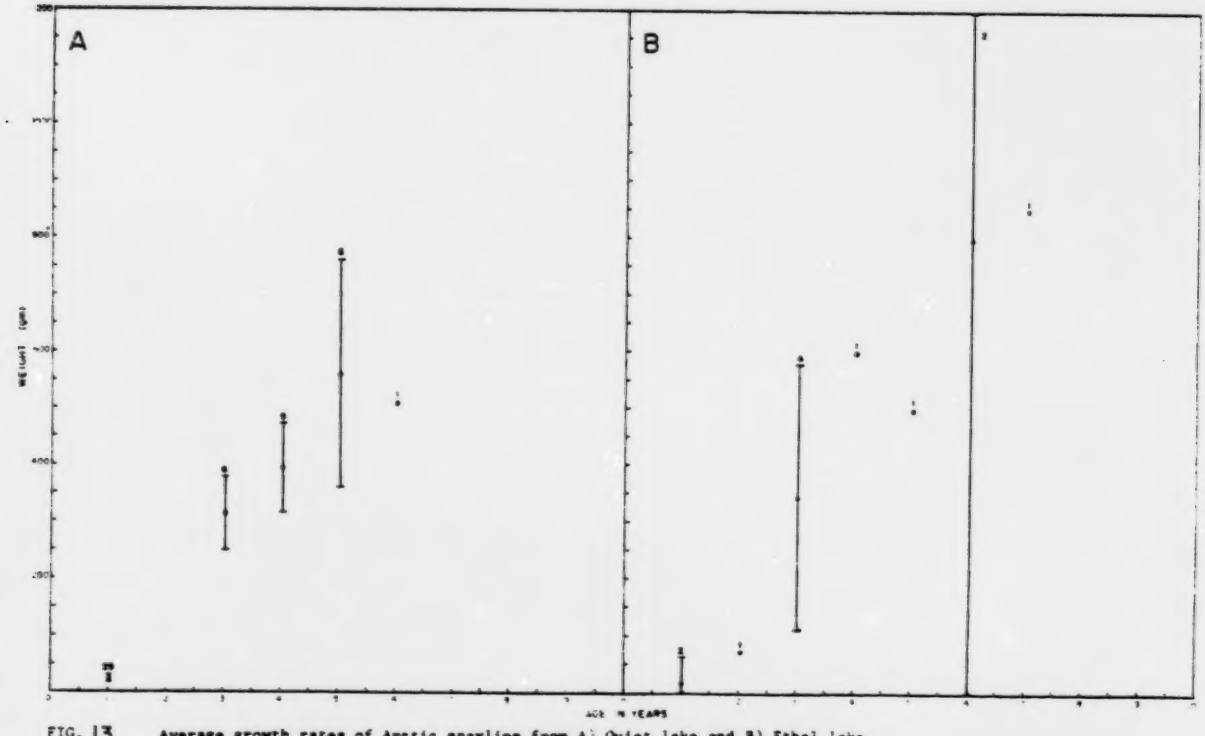


FIG. 13 Average growth rates of Arctic grayling from A) Quiet lake and B) Ethel lake showing 95% confidence intervals and sample sizes.

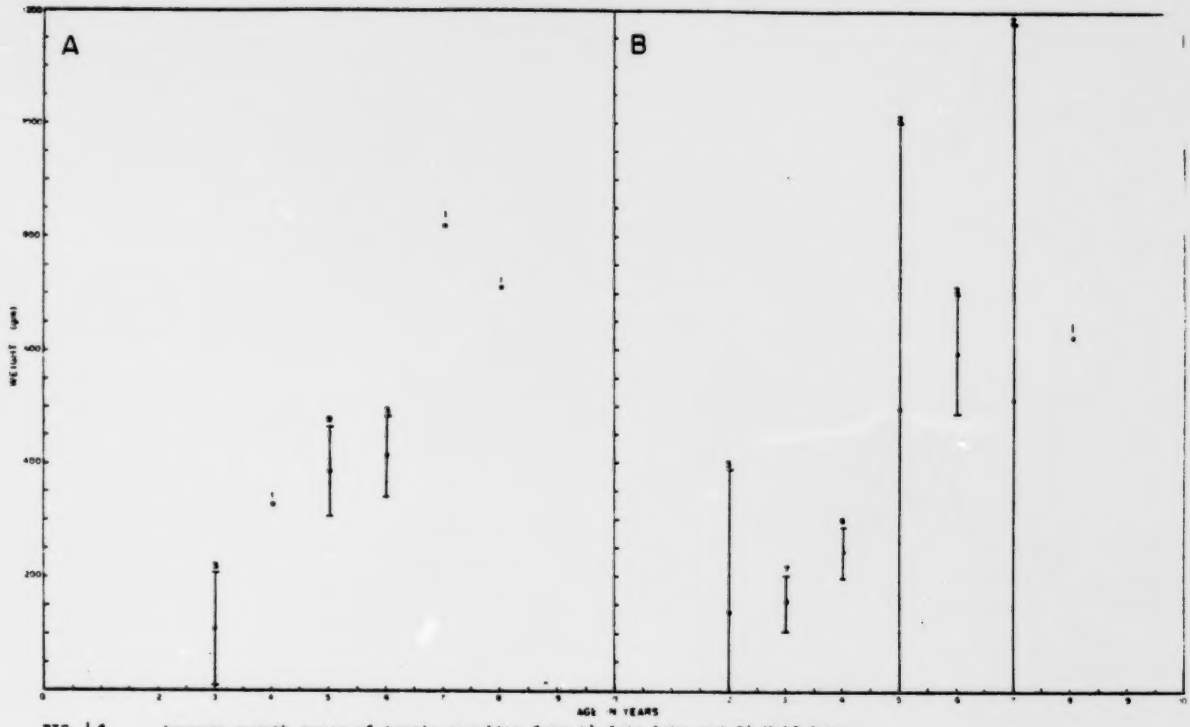


FIG. 14 Average growth rates of Arctic grayling from:A) Jojo lake and B) Wolf lake showing 95% confidence intervals and sample sizes.

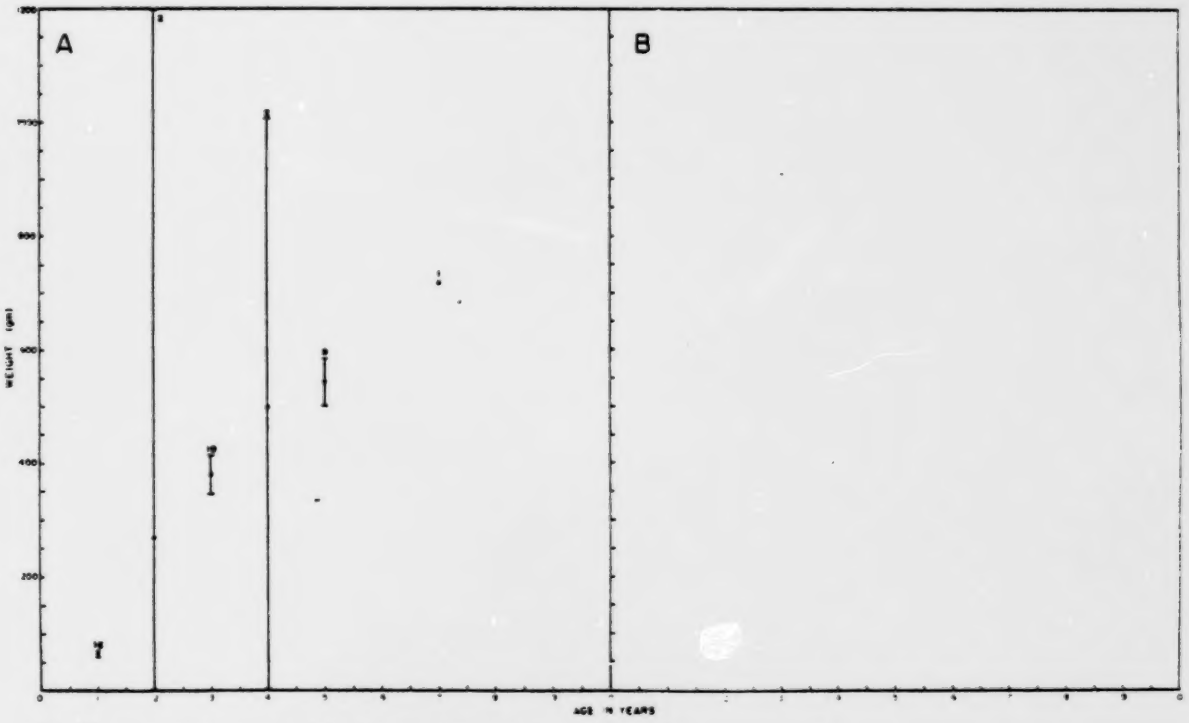


FIG. 15 Average growth rates of Arctic grayling from:A) Fox lake showing 95% confidence intervals and sample sizes.

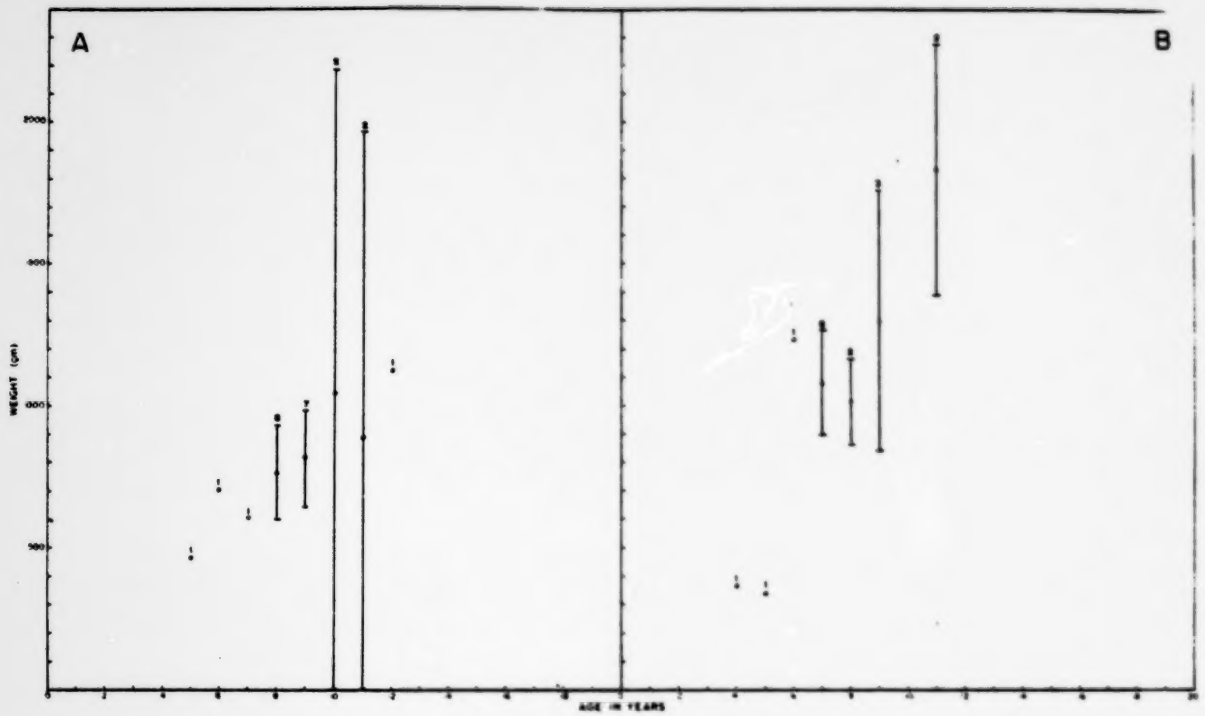


FIG. 16. Average growth rates of humpback whitefish from:A) Mayo Lake and B) Wolf Lake showing 95% confidence intervals and sample sizes.

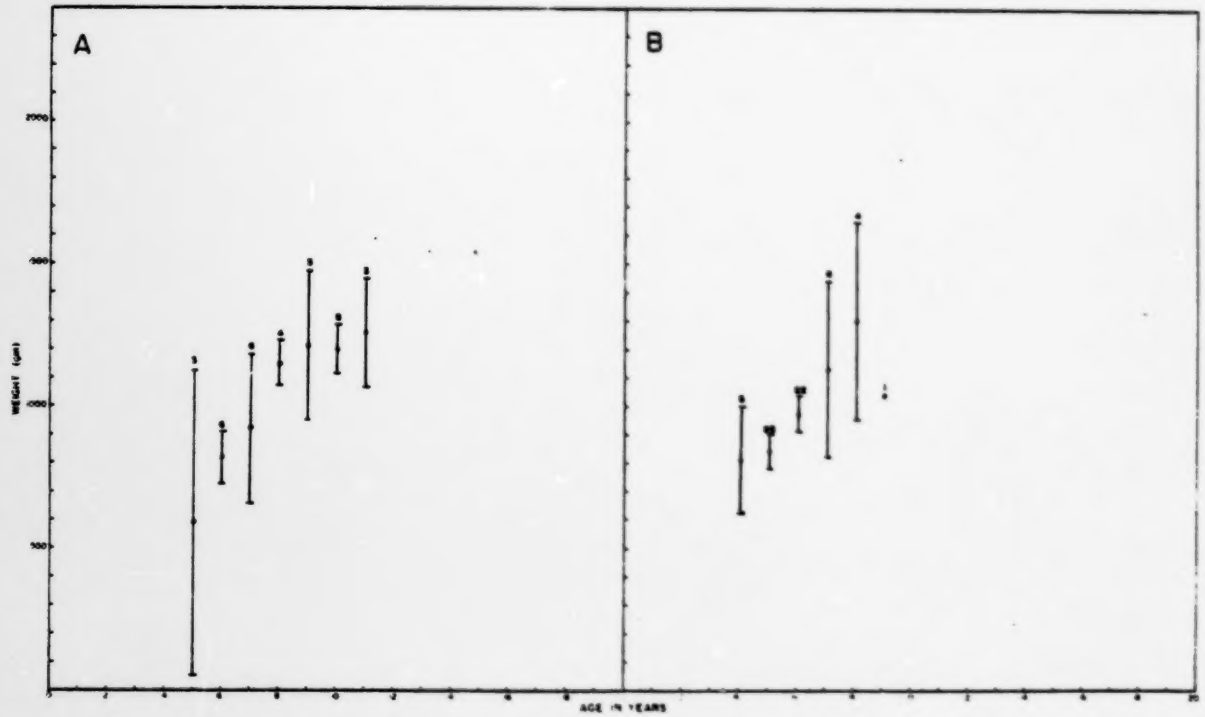


FIG. 17. Average growth rates of humpback whitefish from:A) Ethel Lake and B) Fox Lake showing 95% confidence intervals and sample sizes.

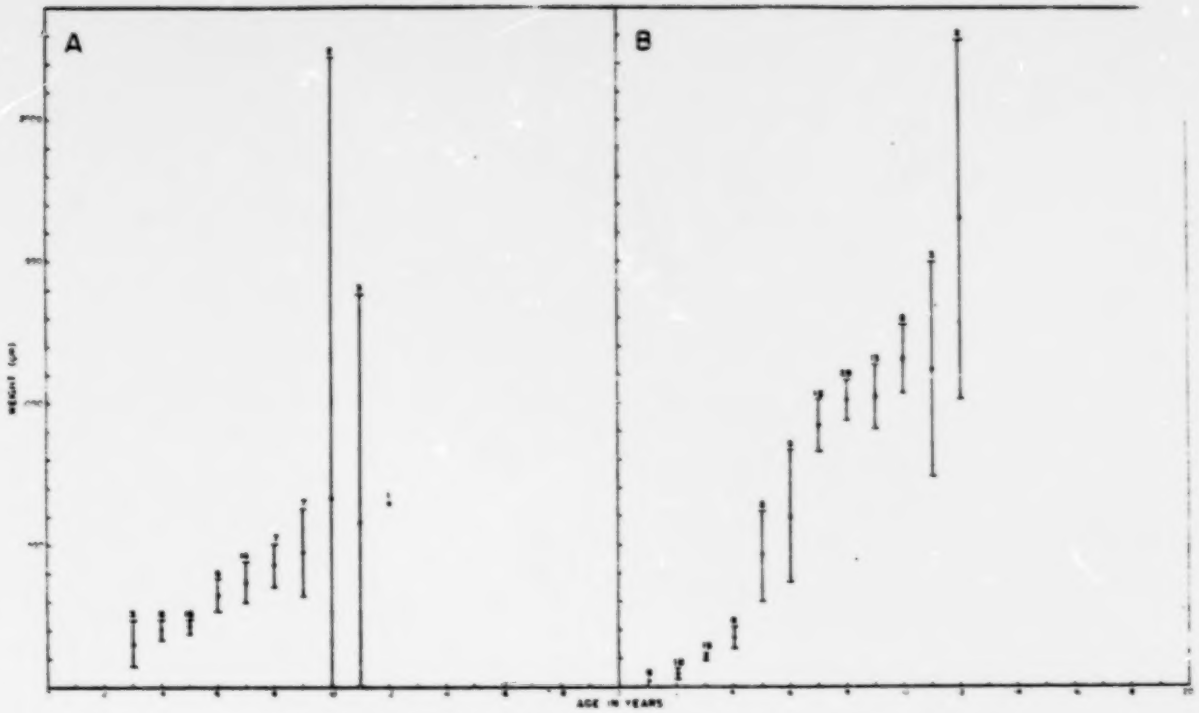


FIG. 18. Average growth rates of humpback whitefish from:A) Dezadeash Lake and B) Little Atlin Lake showing 95% confidence intervals and sample sizes.

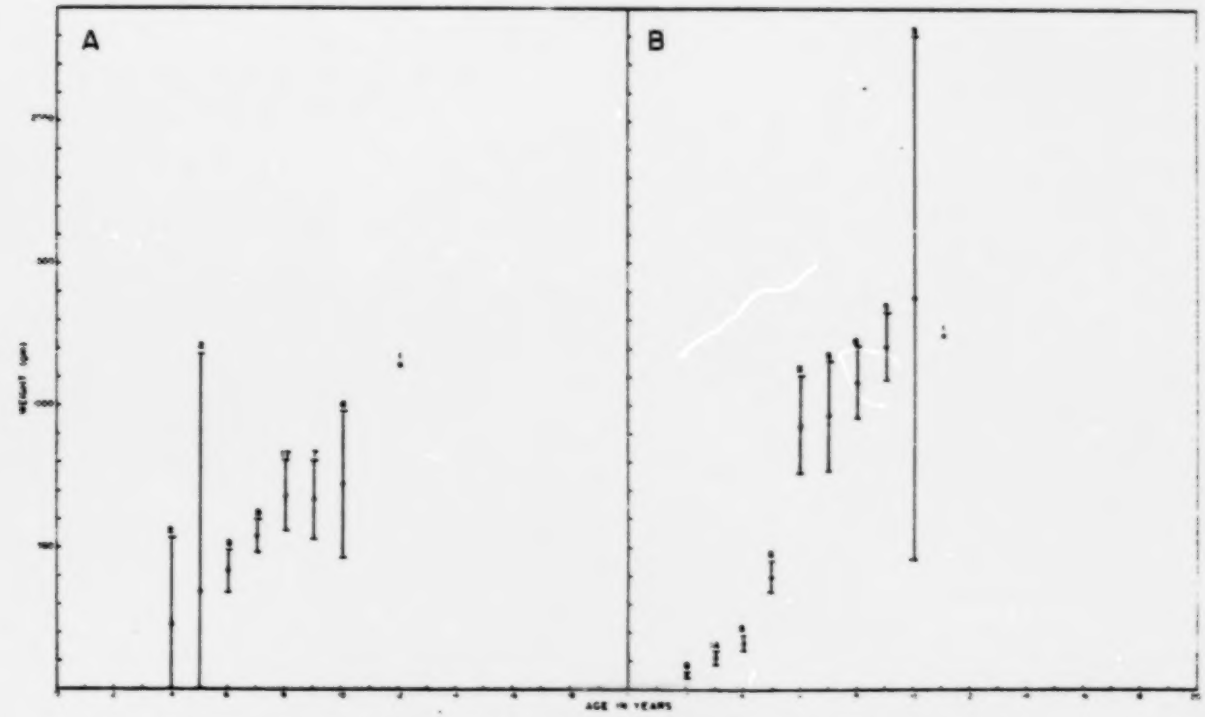


FIG. 19. Average growth rates of humpback whitefish from:A) Michie Lake and B) Twin Lake showing 95% confidence intervals and sample sizes.

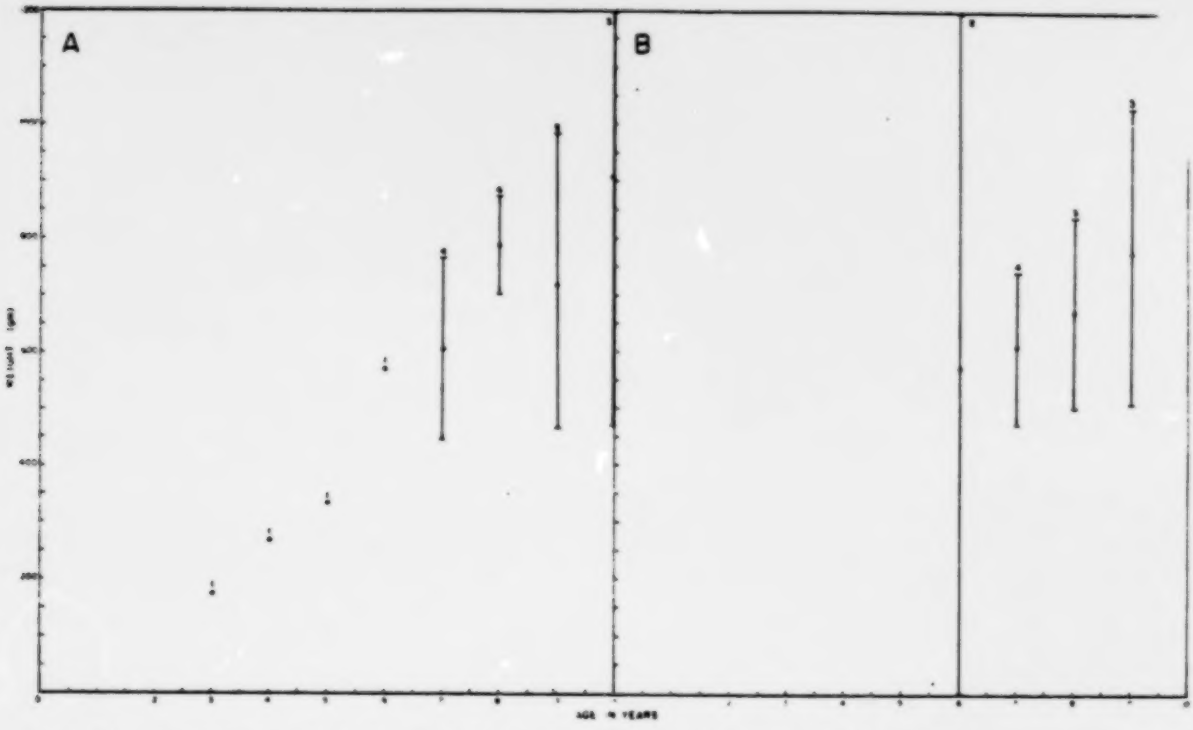


FIG. 20. Average growth rates of round whitefish from:A) Big Kalzas Lake and B) Little Salmon Lake showing 95% confidence intervals and sample sizes.

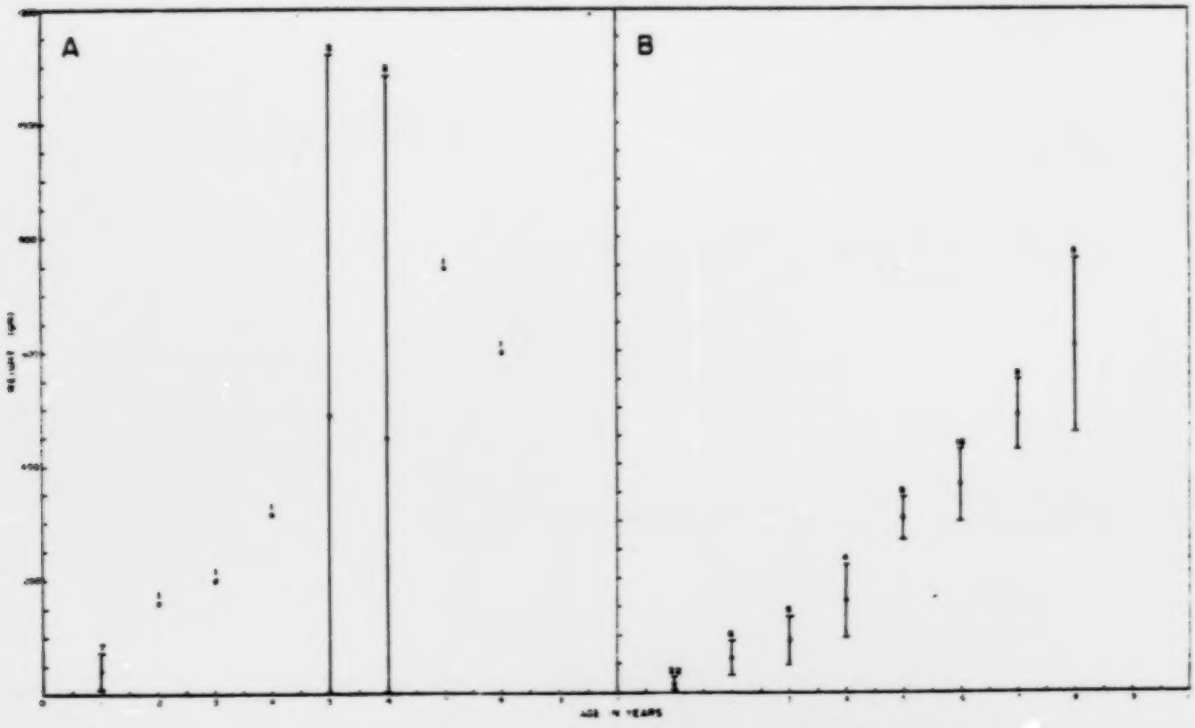


FIG. 21. Average growth rates of round whitefish from:A) Mayo Lake and B) Wolf Lake showing 95% confidence intervals and sample sizes.

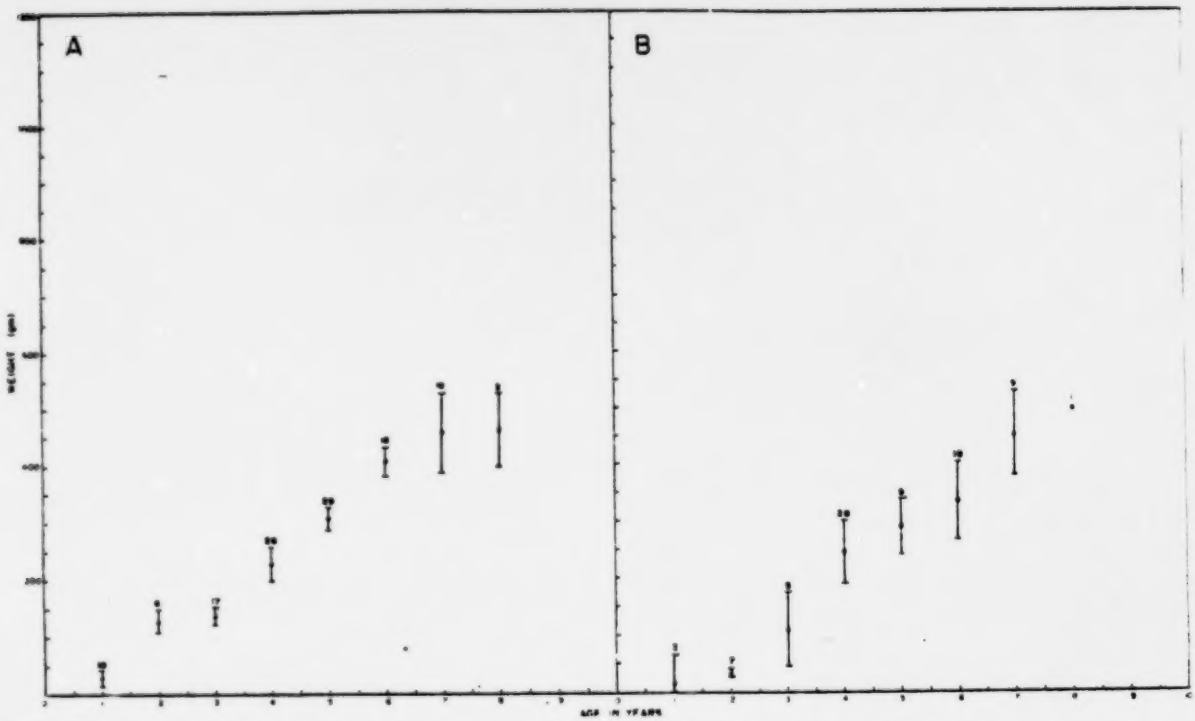


FIG. 22. Average growth rates of round whitefish from: A) Quiet Lake and B) Ethel Lake showing 95% confidence intervals and sample sizes.

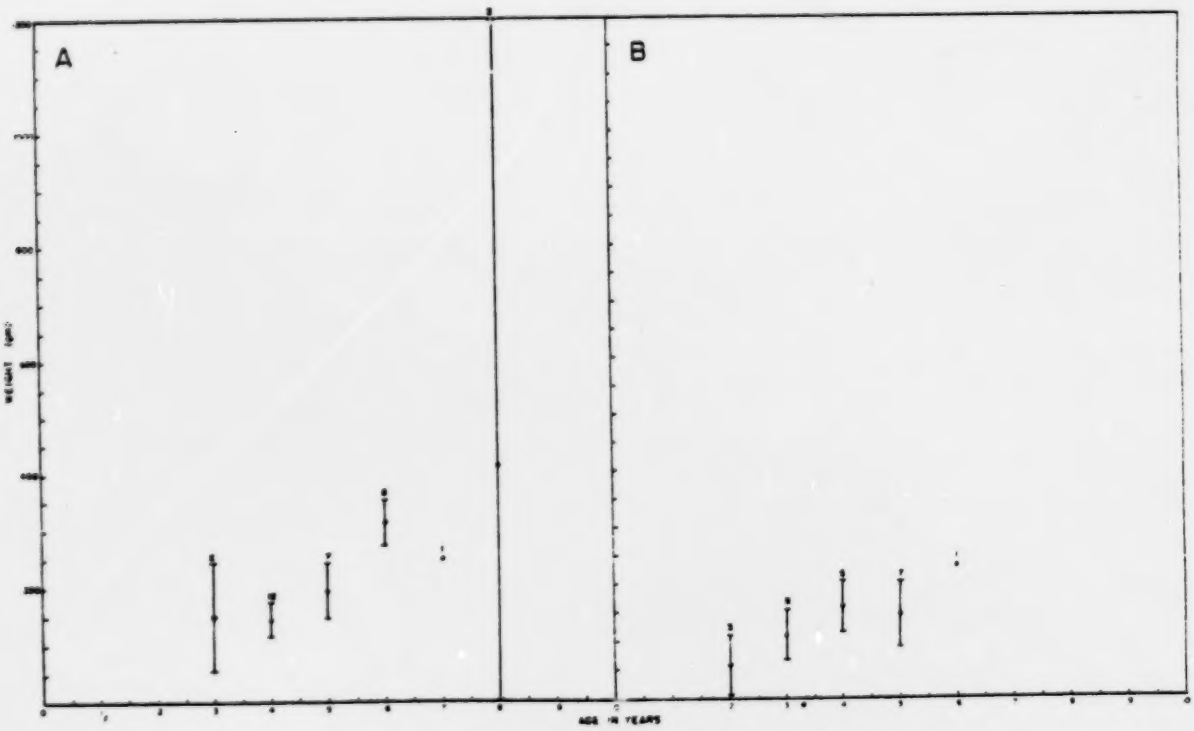


FIG. 23. Average growth rates of round whitefish from: A) Dezadeash Lake and B) Little Atlin Lake showing 95% confidence intervals and sample sizes.

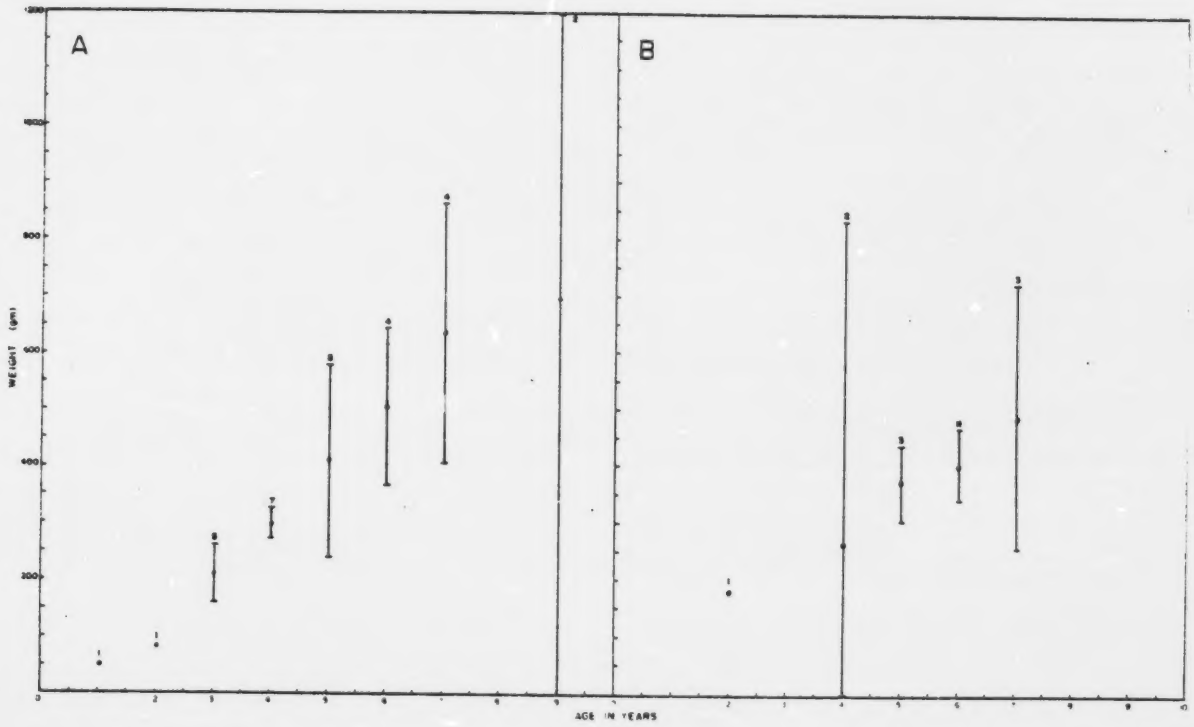


FIG. 24. Average growth rates of round whitefish from A) Claire Lake and B) Fox Lake showing 95% confidence intervals and sample sizes.

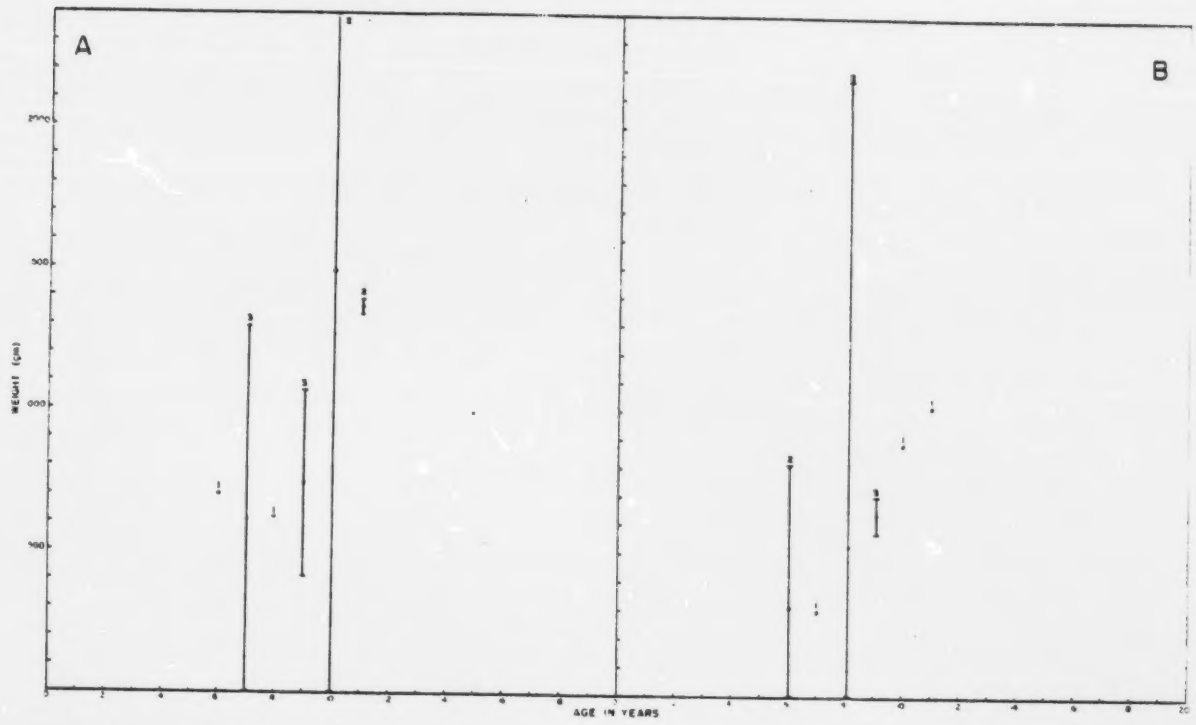


FIG. 25. Average growth rates of burbot from A) Little Atlin Lake and B) Quiet Lake showing 95% confidence intervals and sample sizes.

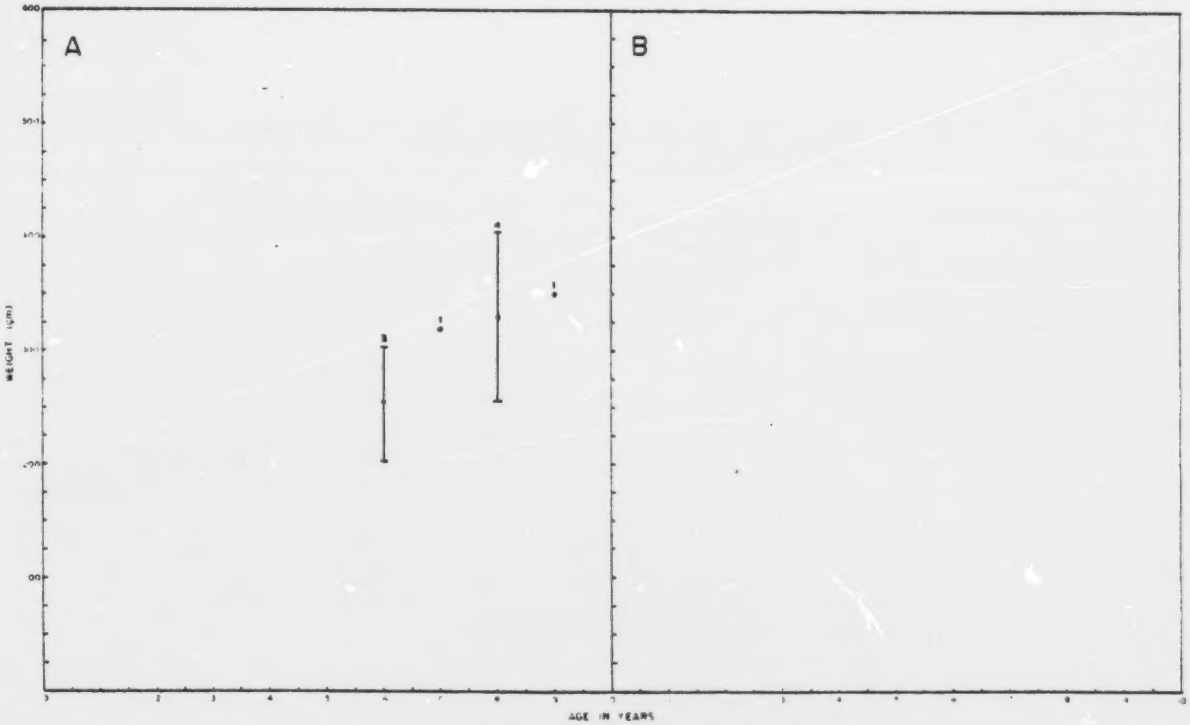


FIG. 26. Average growth rates of broad whitefish from A) Snafu Lake showing 95% confidence intervals and sample sizes.

sample sizes ($n < 10$) were prevalent for most age classes.

Mean weights per age class of humpback whitefish appear in Figures 16 through 19. Good representation covering a broad range of age classes was obtained from Ethel, Dezadeash, Little Atlin, Michie and Twin Lakes. Sigmoid growth curves are apparent for Little Atlin and Twin Lakes (Fig. 18B and 19B) with exponential growth occurring generally to age seven. Dezadeash and Michie Lakes displayed slowest growth rates as observed in Figures 18A and 19A.

Further comparisons of growth are illustrated in Figure 9 for least cisco, Figure 10 and 11 for northern pike, Figures 20 to 24 for round whitefish, Figure 25 for burbot and Figure 26 for broad whitefish.

Natural log equations determined for weight versus age, were found to be unsuitable descriptors of growth in that most equations created exponential growth curves. Equations derived for any population which provided adequate samples are presented in Appendix E.

Ford equations, calculated for populations which had a sufficient representation, are presented in table 37. Walford plots compiled from these equations are presented in Figures 27 to 43 and show the Walford regressions. Values for L_∞ and W_∞ derived from the Walford plots are also presented in Table 37.

Only 4 of the 17 lakes where lake trout were caught yielded sufficient information to determine Ford equations. This was primarily the result of missing age classes and/or small sample sizes. Alligator, Claire, Jojo and Quiet Lake all produced good

Table 37 . Summary of Walford equations and Brody Growth Coefficients

SPECIES	LAKE	ANALYSIS FOR: FORK LENGTH (L) mm OR WEIGHT (W) gms	WALFORD PLOTS $L_{t+1} = a + b\ (L_t)$ OR $W_{t+1} = a + b\ (W_t)$	L_∞ OR W_∞	CORRELATION COEFFICIENTS r	BRODY GROWTH COEFFICIENT	AGE DELETED (small N)
Grayling	Alligator	L	$L_{t+1} = 129.3 + 0.70\ L_t$	423.9	0.97	0.36	
		W	$W_{t+1} = 170.2 + 0.84\ W_t$	1050.6	0.97	0.18	
Grayling	Claire	L	$L_{t+1} = 144.4 + 0.63\ L_t$	390.3	0.85	0.46	
		W	$W_{t+1} = 172.1 + 0.75\ W_t$	677.6	0.81	0.29	
Grayling	Jojo	L	$L_{t+1} = 292.6 + 0.14\ L_t$	340.2	0.79	1.97	7,8
		W	$W_{t+1} = 326.8 + 0.20\ W_t$	408.5	0.95	1.61	7,8
Grayling	Fox	L	$L_{t+1} = 184.3 + 0.52\ L_t$	384.0	0.99	0.65	6,7
		W	$W_{t+1} = 221.0 + 0.67\ W_t$	669.7	0.99	0.40	6,7
Grayling	Wolf	L	$L_{t+1} = 109.3 + 0.71\ L_t$	376.9	0.73	0.34	1,8
		W	$W_{t+1} = 160.1 + 0.74\ W_t$	615.8	0.81	0.30	1,8
Humpback Whitefish	Fox	L	$L_{t+1} = 62.5 + 0.89\ L_t$	568.2	0.84	0.12	1,2,3, 8,9
Humpback Whitefish	Twin West	L	$L_{t+1} = 100.2 + 0.79\ L_t$	477.1	0.94	0.24	
		W	$W_{t+1} = 191.8 + 0.96\ W_t$	4795.0	0.94	0.04	
Humpback Whitefish	Dezadeash	L	$L_{t+1} = 67.9 + 0.83\ L_t$	399.4	0.96	0.19	12
		W	$W_{t+1} = 108.5 + 0.85\ W_t$	723.3	0.88	0.16	12
Humpback Whitefish	Quiet	L	$L_{t+1} = 246.8 + 0.48\ L_t$	474.6	0.84	0.73	3,4,5
		W	$W_{t+1} = 939.1 + 0.29\ W_t$	1322.7	0.68	1.20	3,4,5
Humpback Whitefish	Little Atlin	L	$L_{t+1} = 71.2 + 0.87\ L_t$	547.7	0.97	0.14	
Humpback Whitefish	Ethel	L	$L_{t+1} = 174.1 + 0.62\ L_t$	452.2	0.87	0.49	
		W	$W_{t+1} = 425.1 + 0.68\ W_t$	1341.0	0.95	0.38	
Humpback Whitefish	Michie	L	$L_{t+1} = 95.5 + 0.77\ L_t$	415.2	0.93	0.26	12
		W	$W_{t+1} = 169.6 + 0.82\ W_t$	942.2	0.95	0.20	12
Humpback Whitefish	Snafu	L	$L_{t+1} = 205.1 + 0.40\ L_t$	341.8	0.87	0.92	5,6,11
		W	$W_{t+1} = 114.7 + 0.79\ W_t$	546.2	0.90	0.24	5,6,11
Pike	Taye	L	$L_{t+1} = 299.9 + 0.45\ L_t$	545.3	0.83	0.80	4,5
		W	$W_{t+1} = 915.9 + 0.10\ W_t$	1017.7	0.77	2.30	4,5
Burbot	Quiet	W	$W_{t+1} = 120.8 + 0.97\ W_t$	4026.7	0.73	0.03	10,11

Table 37 . Continued

SPECIES	LAKE	ANALYSIS FOR: FORK LENGTH (L) mm OR WEIGHT (W) gms	WALFORD PLOTS $L_{t+1} = a + b(L_t)$ OR $W_{t+1} = a + b(W_t)$	L_∞ OR W_∞	CORRELATION COEFFICIENTS r	BRODY GROWTH COEFFICIENT	AGE DELETED (small N)
Least Cisco	Twin West	L	$L_{t+1} = 93.0 + 0.68\ L_t$	290.6	0.95	0.39	
		W	$W_{t+1} = 92.9 + 0.71\ W_t$	320.3	0.92	0.34	
Least Cisco	Quiet	L	$L_{t+1} = 110.4 + 0.60\ L_t$	276.0	1.00	0.51	
		W	$W_{t+1} = 55.2 + 0.91\ W_t$	613.3	1.00	0.09	
Round Whitefish	Fox	L	$L_{t+1} = 128.9 + 0.67\ L_t$	390.6	0.99	0.40	2
		W	$W_{t+1} = 193.1 + 0.66\ W_t$	567.9	0.83	0.42	2
Round Whitefish	Wolf	L	$L_{t+1} = 77.3 + 0.84\ L_t$	483.1	0.99	0.17	
Round Whitefish	Quiet	L	$L_{t+1} = 124.5 + 0.66\ L_t$	366.2	0.93	0.42	8
		W	$W_{t+1} = 77.0 + 0.97\ W_t$	2566.7	0.97	0.03	8
Round Whitefish	Little Atlin	L	$L_{t+1} = 183.4 + 0.31\ L_t$	265.8	0.83	1.17	7
		W	$W_{t+1} = 115.8 + 0.47\ W_t$	218.5	0.91	0.76	7
Round Whitefish	Mayo	L	$L_{t+1} = 123.8 + 0.69\ L_t$	399.4	0.98	0.37	7,8,13,14
		W	$W_{t+1} = 141.4 + 0.75\ W_t$	565.6	0.87	0.30	7,8,13,14
Round Whitefish	Ethel	L	$L_{t+1} = 122.9 + 0.67\ L_t$	366.9	0.99	0.41	1,8
		W	$W_{t+1} = 94.5 + 0.95\ W_t$	1889.2	0.95	0.05	1,8
Round Whitefish	Big Kalzas	L	$L_{t+1} = 133.2 + 0.69\ L_t$	432.5	0.86	0.37	
		W	$W_{t+1} = 162.8 + 0.88\ W_t$	1345.5	0.90	0.13	
Round Whitefish	Claire	L	$L_{t+1} = 79.4 + 0.86\ L_t$	563.1	0.95	0.15	
		W	$W_{t+1} = 98.8 + 0.96\ W_t$	2744.7	0.96	0.04	
Lake Trout	Wolf	W	$W_{t+1} = 737.2 + 0.64\ W_t$	2047.8	0.56	0.45	6,20,21,23-31
Lake Trout	Jojo	L	$L_{t+1} = 103.8 + 0.72\ L_t$	370.7	0.88	0.33	4,5,6,25-31
		W	$W_{t+1} = 227.6 + 0.63\ W_t$	615.1	0.70	0.46	4,5,6,25-31
Lake Trout	Alligator	L	$L_{t+1} = 197.7 + 0.53\ L_t$	420.6	0.93	0.64	28-31,36
		W	$W_{t+1} = 274.9 + 0.73\ W_t$	1006.9	0.85	0.32	28-31,36
Lake Trout	Quiet	L	$L_{t+1} = 273.7 + 0.38\ L_t$	441.5	0.84	0.97	4-10, 16-19
		W	$W_{t+1} = 486.9 + 0.49\ W_t$	954.7	0.86	0.71	4-10, 16-19
Lake Trout	Claire	L	$L_{t+1} = 115.5 + 0.72\ L_t$	408.1	0.84	0.33	
		W	$W_{t+1} = 128.4 + 0.85\ W_t$	867.6	0.93	0.16	

results in that the correlation of respective Walford regressions was high and the values of L_{∞} and W_{∞} fell within reasonable limits (Figs. 27 and 28).

In order to reduce the capture of trophy lake trout, mesh sizes were limited to 8.9 cm (3.5"). This may have some effect on the interpretation of growth information presented in this study. For example, an under-representation of older age classes and larger fish could cause premature levelling of growth trends and lead to lower estimates for L_{∞} and W_{∞}. However, the relevance of this effect is questionable since larger lake trout generally represent a small proportion of exploited populations.

Length relationships were examined in the Walford plots for the Arctic grayling populations of Alligator, Claire, Fox, Jojo and Wolf Lakes (Figs. 31 and 34). Evaluations of weight patterns were also possible in all of these lakes except Alligator where an unreasonable W_{∞} value of 1050 g was obtained (Figs. 32 and 33). All lakes showed slopes of less than unity in the Walford plots yielding realistic L_{∞} and W_{∞} values.

Seven lakes, (Michie, Quiet, Ethel, Dezadeash, Little Atlin, Snafu and Twin) provided adequate sample sizes of humpback whitefish to generate Walford regressions for length (Fig. 36 and 38). A further calculation of weight relationships was also possible on all of these lakes but Little Atlin where the necessary information was lacking (Fig. 35 and 37). All slopes were less than unity with reasonable L_{∞} and W_{∞} values obtained for all regressions except for the W_{∞} of 4795 g for Twin Lake. The length plot for Little Atlin (Fig. 36) and the weight plot for Twin Lake (Fig. 35) both converge on unity off the graph. The L_{∞} for Little Atlin of 547.7 mm is large,

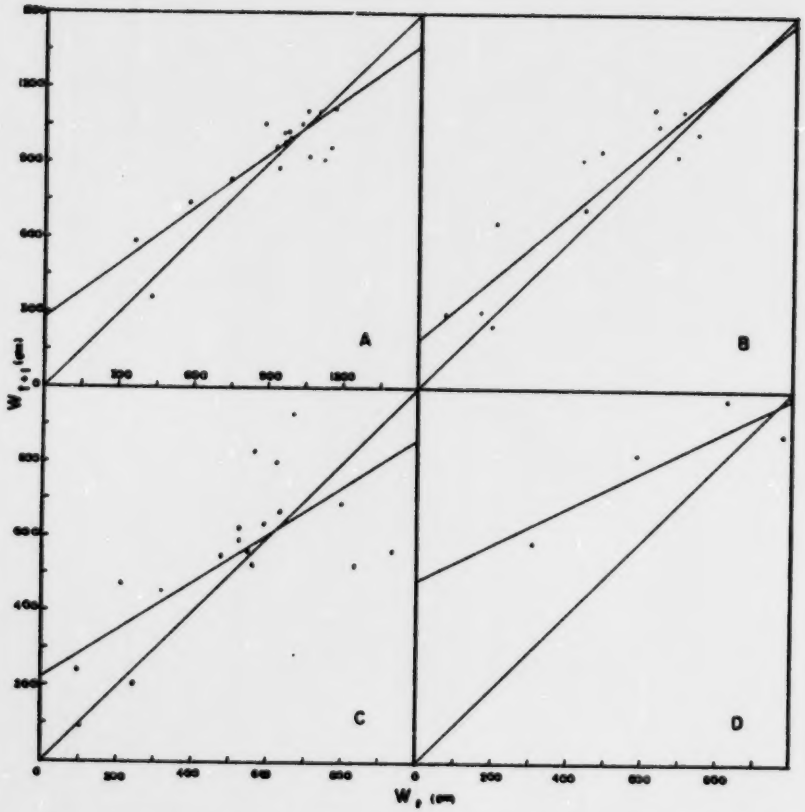


FIG. 27. Walford plots showing the weight relationship for lake trout in: A) Alligator Lake, B) Claire Lake, C) Jojo Lake, D) Quiet Lake.

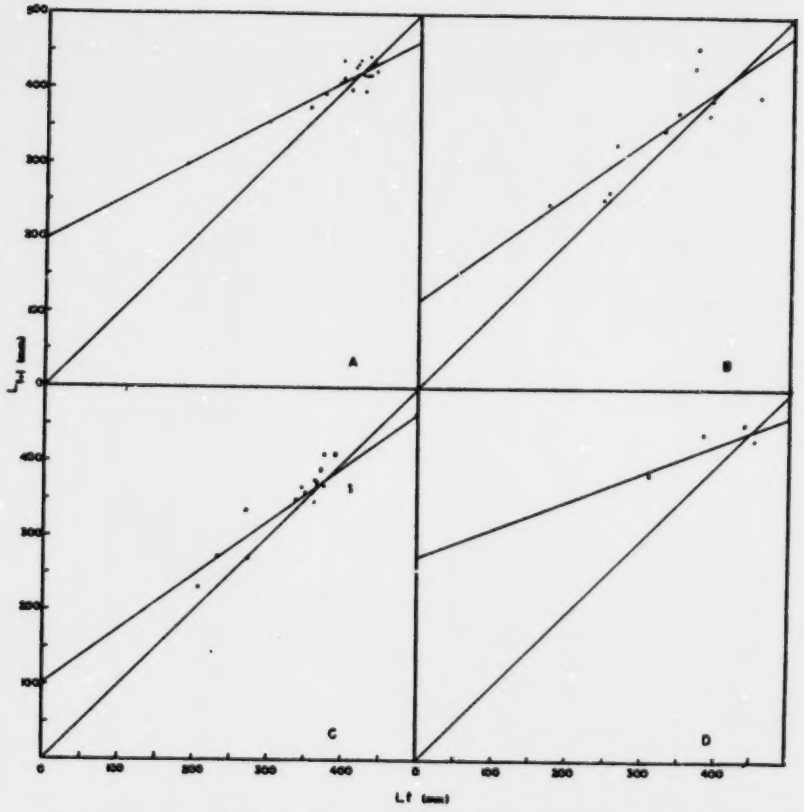


FIG. 28. Walford plots showing the length relationship for lake trout in: A) Alligator, B) Claire Lake, C) Jojo Lake, D) Quiet Lake.

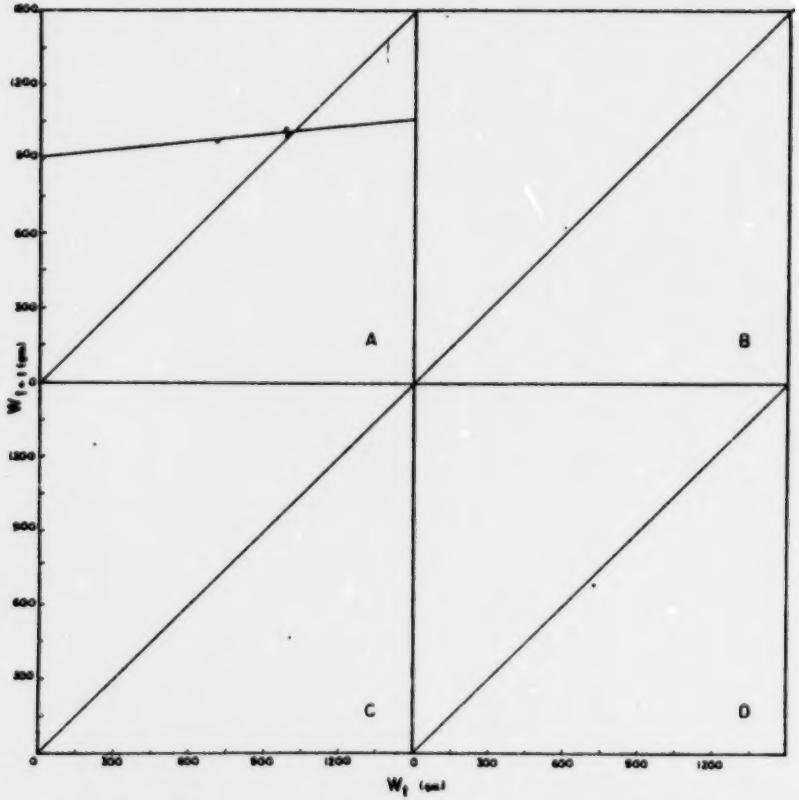


FIG. 29. Walford plots showing the weight relationship for northern pike in A) Taye Lake.

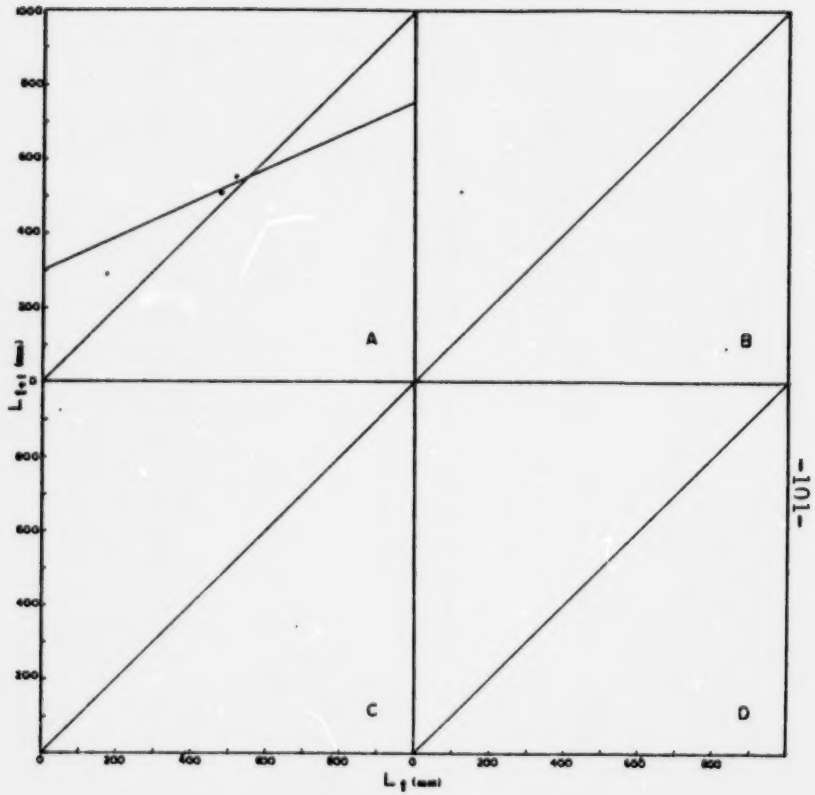


FIG. 30. Walford plots showing the length relationship for northern pike in A) Taye Lake.

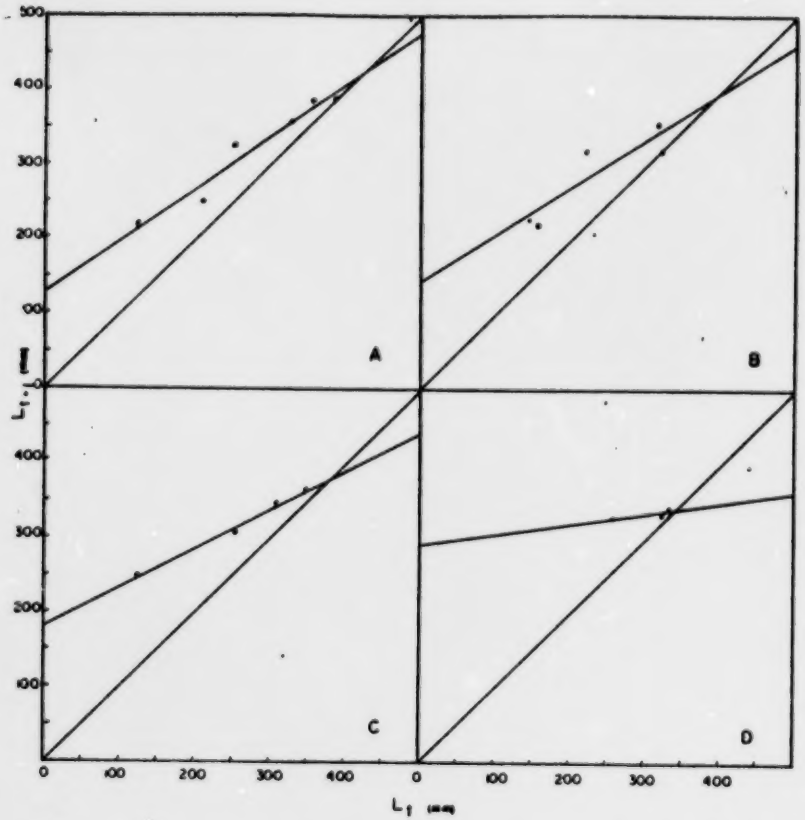


FIG. 31. Walford plots showing the length relationship for Arctic grayling in:A) Alligator Lake, B) Claire Lake, C) Fox Lake, D) Jojo Lake.

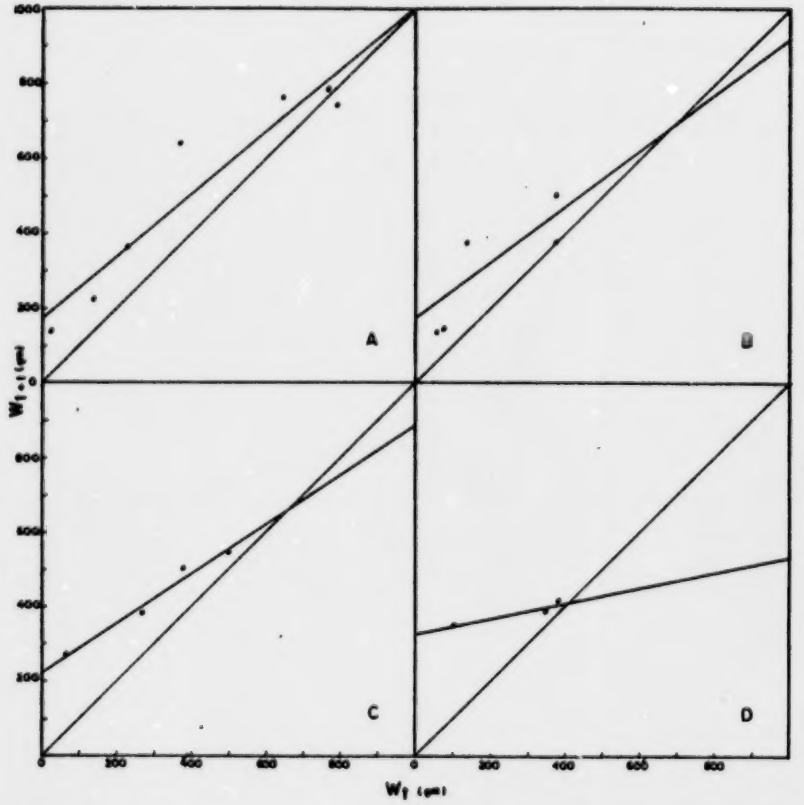


FIG. 32. Walford plots showing the weight relationship for Arctic grayling in:A) Alligator Lake, B) Claire Lake, C) Fox Lake, D) Jojo Lake.

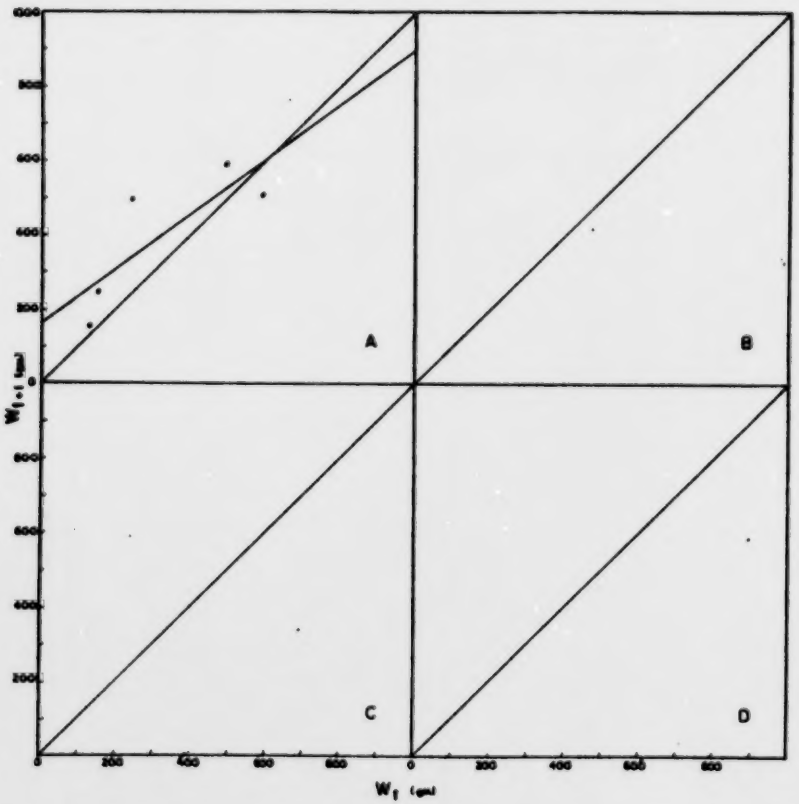


FIG. 33. Walford plots showing the weight relationship for Arctic grayling in A) Wolf Lake.

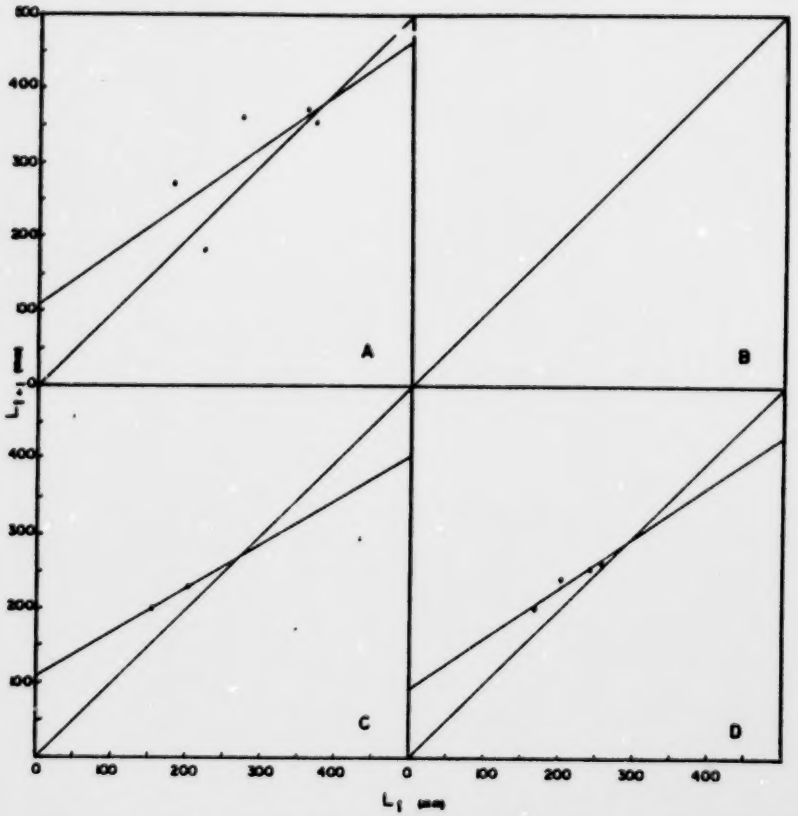


FIG. 34. Walford plots showing the length relationship for Arctic grayling in: A) Wolf Lake, and least cisco in C) Quiet Lake, D) Twin Lake West.

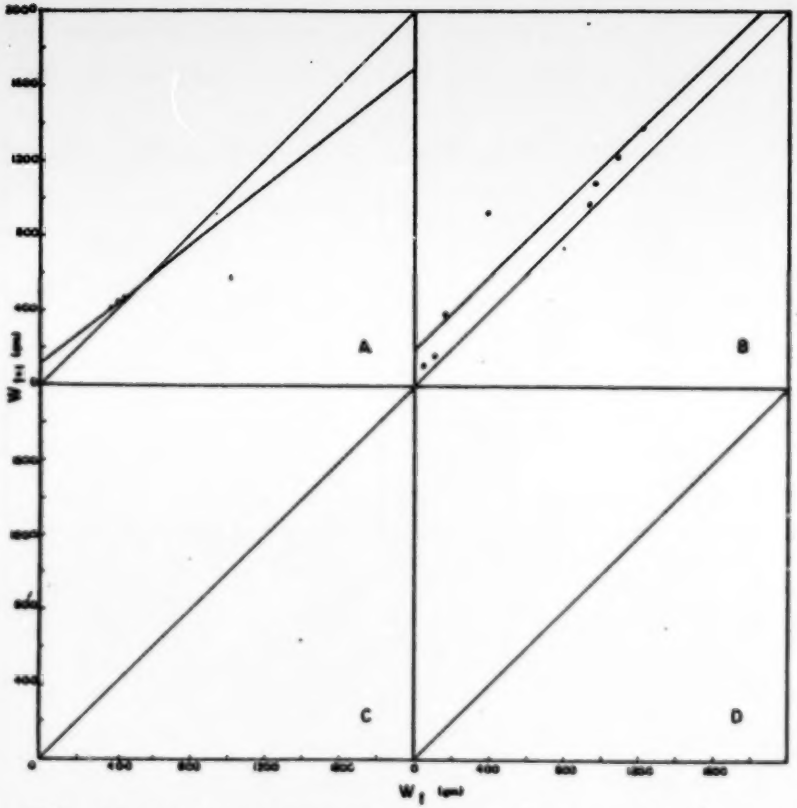


FIG. 35. Walford plots showing the weight relationship for humpback whitefish in:A) Snafu Lake and B) Twin Lake West.

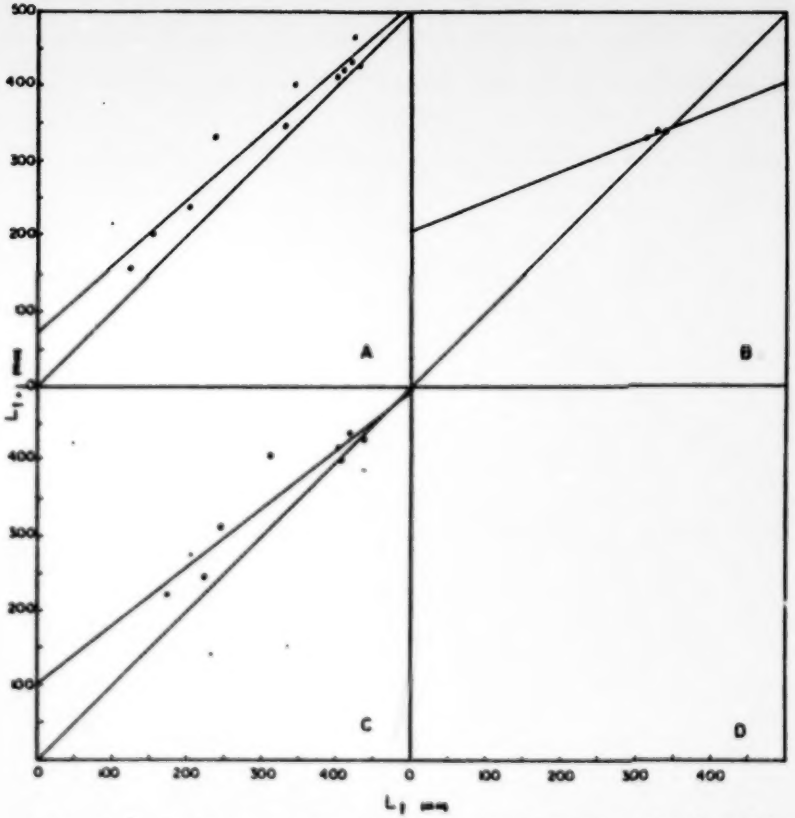


FIG. 36. Walford plots showing the length relationship for humpback whitefish in:A) Little Atlin Lake, B) Snafu Lake, C) Twin Lake West.

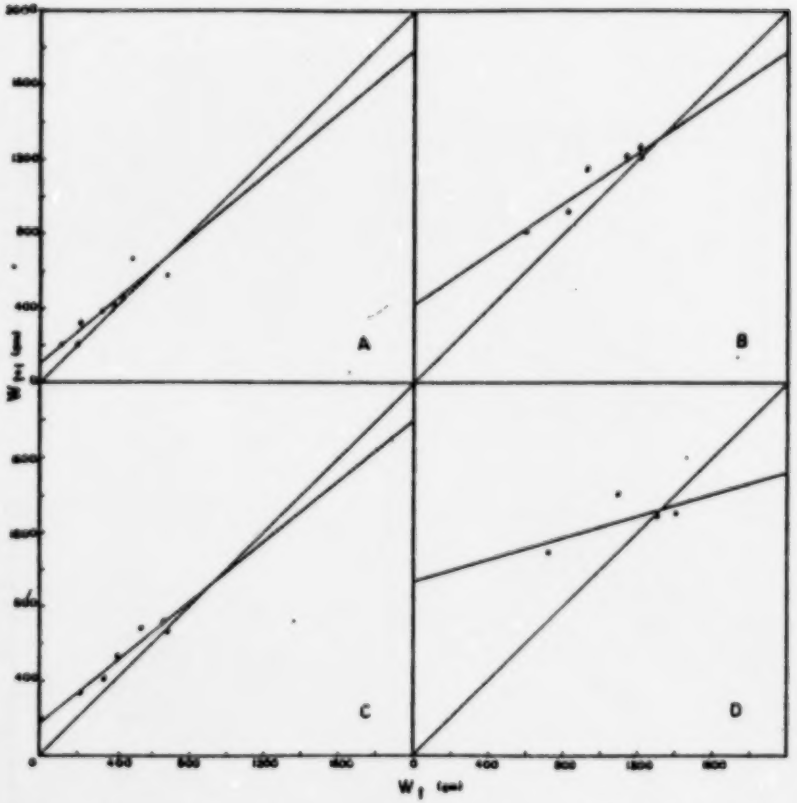


FIG. 37. Walford plots showing the weight relationship for humpback whitefish in:A) Dezadeash Lake, B) Ethel Lake, C) Michie Lake, D) Quiet Lake.

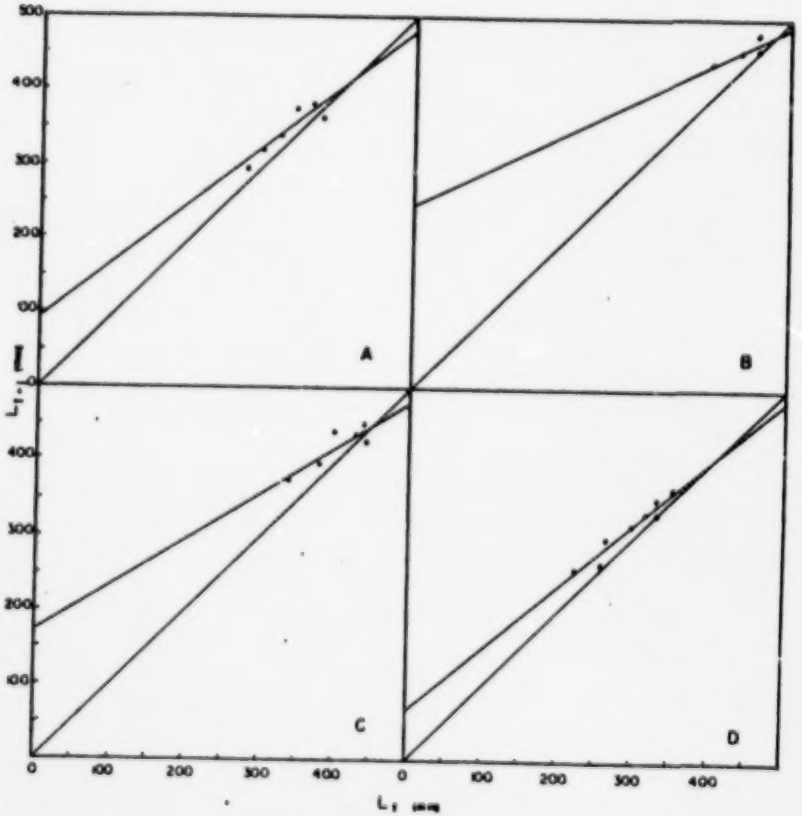


FIG. 38. Walford plots showing the length relationship for humpback whitefish in:A) Michie Lake, B) Quiet Lake C) Ethel Lake, D) Dezadeash Lake.

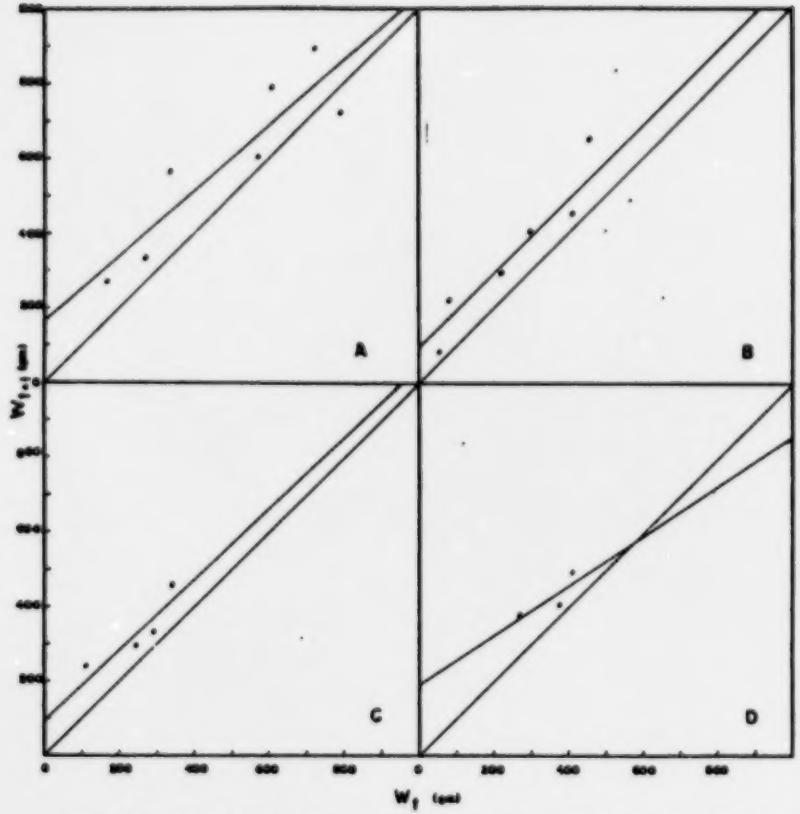


FIG. 39. Walford plots showing the weight relationship for round whitefish in: A) Big Kalzas Lake, B) Claire Lake, C) Ethel Lake, D) Fox Lake.

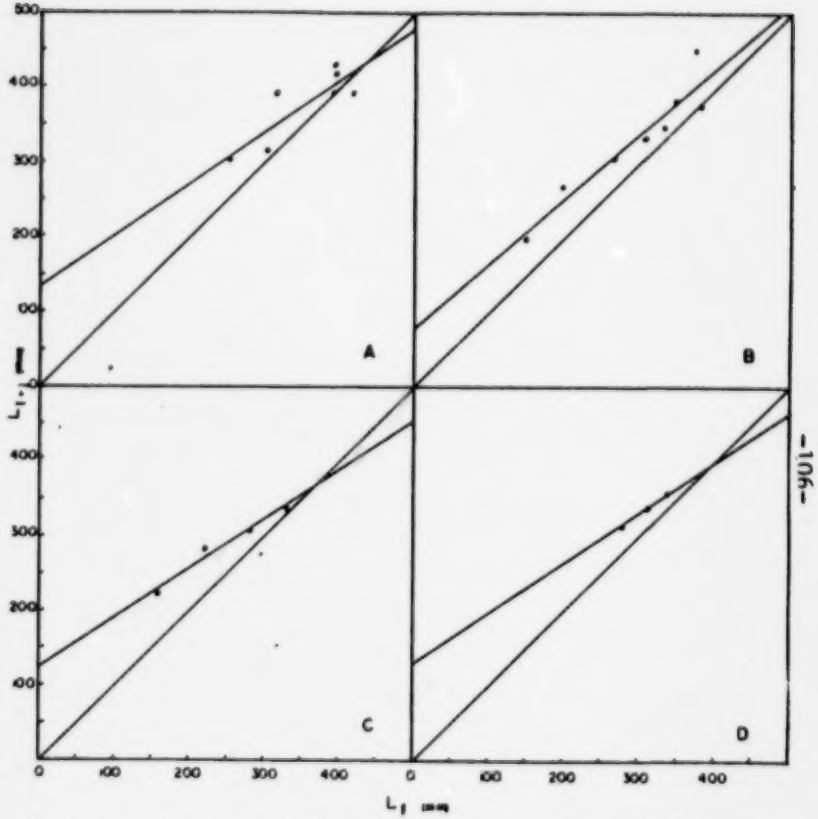


FIG. 40. Walford plots showing the length relationship for round whitefish in: A) Big Kalzas Lake, B) Claire Lake, C) Ethel Lake, D) Fox Lake.

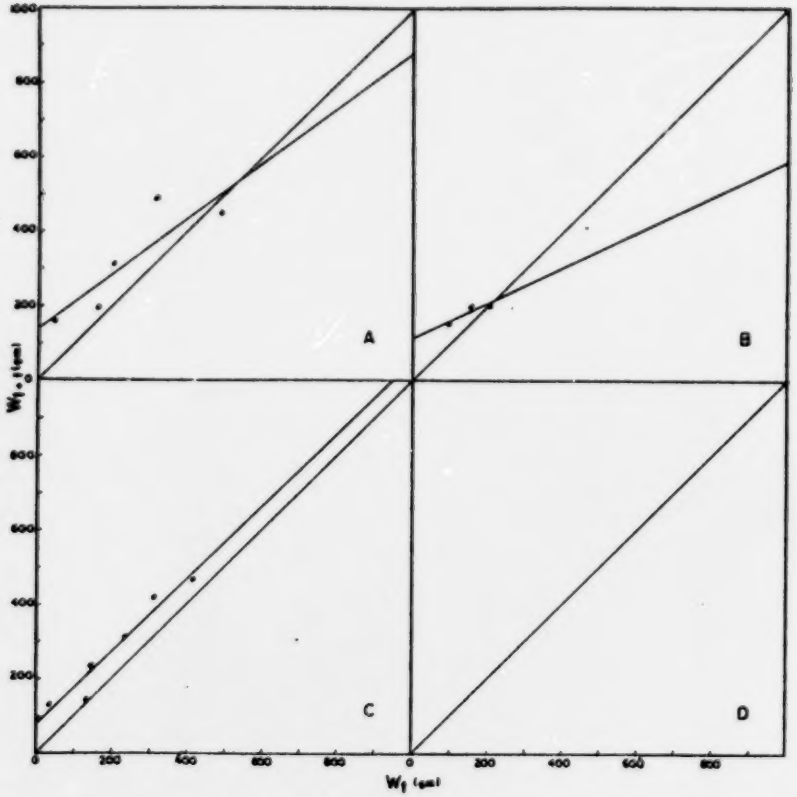


FIG. 41. Walford plots showing the weight relationship for round whitefish in: A) Mayo Lake, B) Little Atlin Lake, C) Quiet Lake.

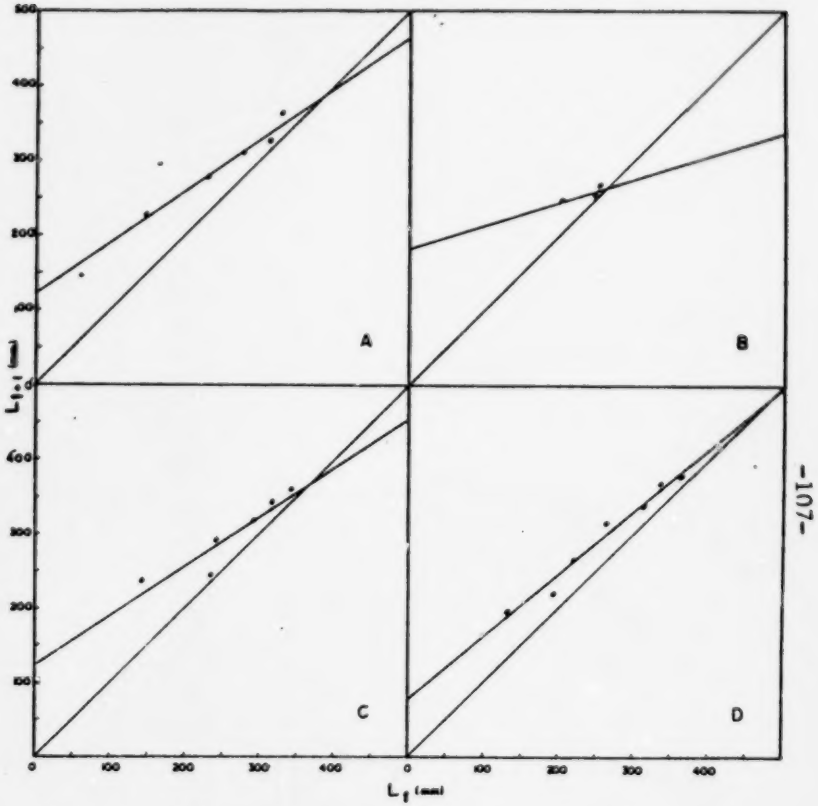


FIG. 42. Walford plots showing the length relationship for round whitefish in: A) Mayo Lake, B) Little Atlin Lake, C) Quiet Lake, D) Wolf Lake.

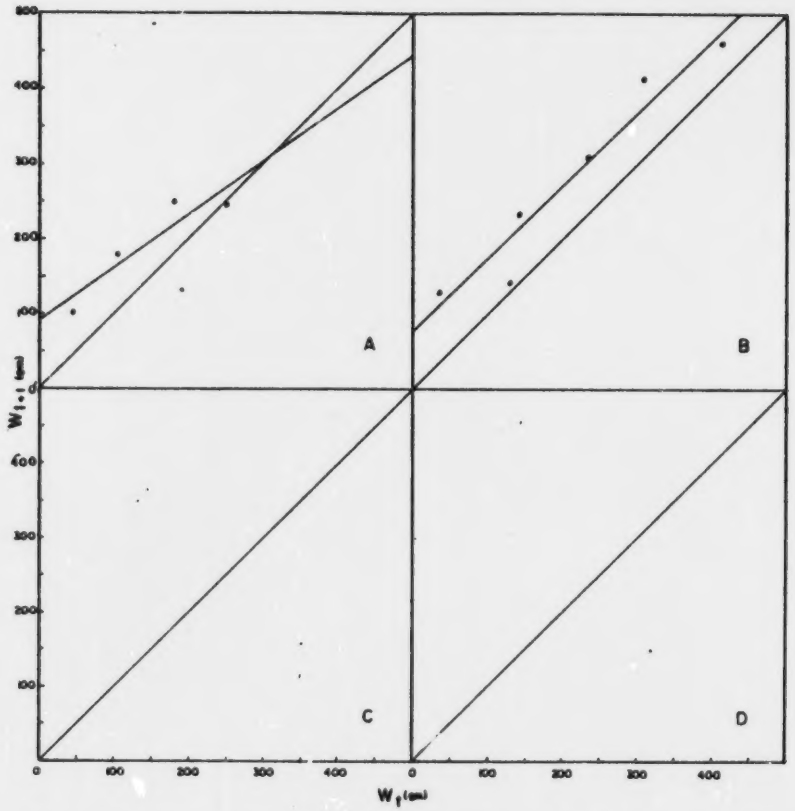


FIG. 43. Walford plots showing the weight relationship for least cisco in:A) Twin Lake West, B) Quiet Lake.

although possible. Such a large L_{∞} or W_{∞} value is usually associated with small sample sizes and few age groups.

Seven lakes provided adequate sample sizes of round whitefish to conduct length analyses (Figs. 40 and 42). These were Big Kalzas, Ethel, Fox,Mayo, Little Atlin, Quiet and Wolf lakes. For Claire Lake, the slope of the regression line was less than unity but Loo occured off the plot with a value of 563.1 mm. On examination of weight relationships, satisfactory results were derived for Fox, Mayo and Little Atlin Lakes only, which all produced reasonable W_{∞} values. Big Kalzas, Claire, Ethel and Quiet Lakes showed unacceptable large W_{∞} values with slopes close to unity in all but the former (Figs. 39 and 41). This representation may be attributed to small sample sizes and some poorly represented age groups.

Two lakes provided sufficient samples for the analyses of the least cisco populations. L_{∞} was derived for both Quiet(276.0mm) and Twin Lakes(290.6mm)(Table 37). The W_{∞} values were 320.3 g and 613.3g respectively (Table 37). The length and weight Walford plots for least cisco from these lakes appear in Figure 34 and 43. The good correlation coefficients (greater than 0.8) for all plots may be attributed to the few age classes (1-3 years) present in the cisco populations.

The values of Brody Growth Coefficients, derived from the calculated Ford equations are presented in Table 37 by species and lake. The difference between the asymptotic size and the actual size of a fish decreases exponentially at a rate equal to this coefficient. The larger the value of the coefficient the more rpaid the decrease in growth ie. the growth curve would level off at a faster rate. Also, a larger coefficient, means a smaller value for

L_{∞} and W_{∞} .

All lakes were ranked according to their relative growth coefficient values. The rankings are presented by weight in Table 38 and by length in Table 39. The lake assigned number one (ie. highest ranking) would theoretically have a smaller maximum size (length or weight) than those numbered higher. It is interesting to note the differences in order between length and weight analysis. Lakes producing the longest fish may not necessarily be the lakes with the heaviest fish, as can be seen among the grayling population in Wolf Lake (Tables 38 and 39).

Some interesting results were seen when the lakes were ranked according to the age specific mean weights of lake trout (Table 40). Twin Lake displayed the smallest mean weights for ages six to twelve years. Then, from age of 13 years and on , a reversal is noted when the mean weights are ranked as the largest of all lakes. A similar but opposite reversal is seen in Alligator Lake, where the trout exhibited the largest mean weight of all the lakes up to age 12 . and then drop into a much lower ranked position from age 12 to 20. This suggests a change in feeding habits around this age, which corresponds to that of maturity (see Section 4.6). The reason for the dramatic change in growth patterns at this age may involve available food sources, efficiecy of food size and energy requirements for reproduction. The change in growth rate in Alligator Lake is also apparent on examination of the growth curve and is seen as a levelling of the curve around the age of maturity (Fig. 8B). Variation in the rates of growth were not prevalent and generally the lakes displayed a fairly constant ranking throughout

Table 38 . Rank order of Lakes according to Brody Growth Coefficient for weight.

RANK	LAKE	SPECIES	BRODY COEFFICIENT
1	Jojo	Grayling	1.61
2	Fox	Grayling	0.40
3	Wolf	Grayling	0.30
4	Claire	Grayling	0.30
5	Alligator	Grayling	0.18
1	Quiet	Lake Trout	0.71
2	JoJo	Lake Trout	0.46
3	Wolf	Lake Trout	0.45
4	Alligator	Lake Trout	0.32
5	Claire	Lake Trout	0.16
1	Little Atlin	Round Whitefish	0.76
2	Fox	Round Whitefish	0.42
3	Mayo	Round Whitefish	0.30
4	Big Kalzas	Round Whitefish	0.13
5	Ethel	Round Whitefish	0.05
6	Claire	Round Whitefish	0.04
7	Quiet	Round Whitefish	0.03
1	Twin West	Least Cisco	0.34
2	Quiet	Least Cisco	0.09
1	Quiet	Burbot	0.03
1	Taye	Pike	2.30
1	Quiet	Humpback Whitefish	1.20
2	Ethel	Humpback Whitefish	0.38
3	Snafu	Humpback Whitefish	0.24
4	Michie	Humpback Whitefish	0.20
5	Dezadeash	Humpback Whitefish	0.16
6	Twin West	Humpback Whitefish	0.04

Table 39 . Rank order of lakes according to Brody Growth Coefficient for length.

RANK	LAKE	SPECIES	BRODY COEFFICIENT
1	Jojo	Grayling	1.97
2	Fox	Grayling	0.65
3	Claire	Grayling	0.46
4	Alligator	Grayling	0.36
5	Wolf	Grayling	0.34
1	Quiet	Lake Trout	0.97
2	Alligator	Lake Trout	0.64
3	Claire	Lake Trout	0.33
4	Jojo	Lake Trout	0.33
1	Little Atlin	Round Whitefish	1.17
2	Quiet	Round Whitefish	0.42
3	Ethel	Round Whitefish	0.41
4	Fox	Round Whitefish	0.40
5	Big Kalzas	Round Whitefish	0.37
6	Mayo	Round Whitefish	0.37
7	Wolf	Round Whitefish	0.17
8	Claire	Round Whitefish	0.15
1	Quiet	Least Cisco	0.51
2	Twin West	Least Cisco	0.39
1	Taye	Pike	0.80
1	Snafu	Humpback Whitefish	0.92
2	Quiet	Humpback Whitefish	0.73
3	Ethel	Humpback Whitefish	0.49
4	Michie	Humpback Whitefish	0.26
5	Twin West	Humpback Whitefish	0.24
6	Dezadeash	Humpback Whitefish	0.19
7	Little Atlin	Humpback Whitefish	0.14
8	Fox	Humpback Whitefish	0.12

LAKE TROUT		COGHLAN	CLAIRE	ALLIGATOR	QUIET	BIG KALZAS	TWIN	FOX	JOJO
	6	7	8	2	6	5	1	3	4
	7	7	5	8	6	3	1	4	2
	8	7	5	8	6	3	1	4	2
	9	6	7	8	5	4	2	1	3
	10	7	6	8	3	5	2	4	1
	11	6	7	8	3	5	1	2	4
AGE	12	36	6	8	5	7	1	2	35
IN	13	6	4	8	5	2	7	1	3
YEARS	14	5	3	4	6	7	8	2	1
	15	8	2	7	4	6	5	3	1
	16	6	4	5	1	7	8	3	2
	17	7	5	35	6	35	8	1	2
	18	6	5	3	7	4	8	1	2
	19	7	6	4	2	5	8	3	1
	20	3	6	2	7	4	8	5	1

ROUND WHITEFISH		LITTLE SALMON	MAYO	CLAIRE	BIG KALZAS	FOX	QUIET	WOLF	ETHEL	DEZADEASH
	3	9	6	7	5	8	3	1	2	4
	4	9	8	7	6	5	3	2	4	1
AGE	5	8	9	7	5	6	4	3	2	1
IN	6	9	6	7	8	4	5	3	2	1
YEARS	7	7	9	8	6	5	3	4	2	1
	8	8	5	7	9	4	2	6	3	1

ARCTIC GRAYLING		FOX	CLAIRE	QUIET	ETHEL	ALLIGATOR	WOLF	JOJO
	1	7	6	5	2	3	4	1
	2	7	55	3	2	55	4	1
	3	7	6	4	5	3	2	1
AGE	4	6	4	5	7	3	1	2
IN	5	5	4	6	3	7	2	1
YEARS	6	7	4	2	6	5	3	1
	7	2	5	7	6	3	1	4
	8	5	4	6	7	3	1	2

HUMPBACK WHITEFISH		QUIET	FOX	WOLF	TWIN	ETHEL	DENNISON	LITTLE ATLIN	GREAT SLAVE	MAYO	LA ROMGE	MICHIE	SNAFU	DEZADEASH
	5	11	13	85	12	10	85	6	4	5	7	2	3	1
	6	8	12	13	11	9	10	6	5	7	4	3	2	1
AGE	7	12	13	11	10	8	9	7	6	4	5	3	2	1
IN	8	13	12	8	10	11	9	7	6	5	4	3	1	2
YEARS	9	13	7	12	10	11	8	9	6	5	4	3	1	2
	10	11	10	13	12	9	7	8	5	6	4	3	1	2

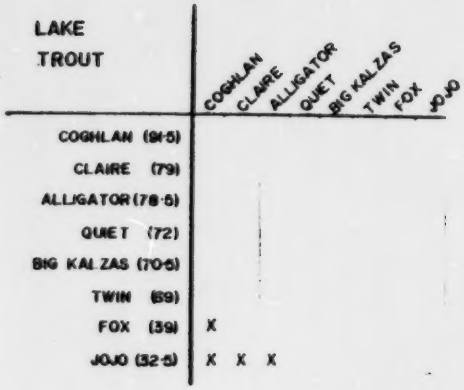
Table 40. Age specific rankings based on mean weights within each age class, by species

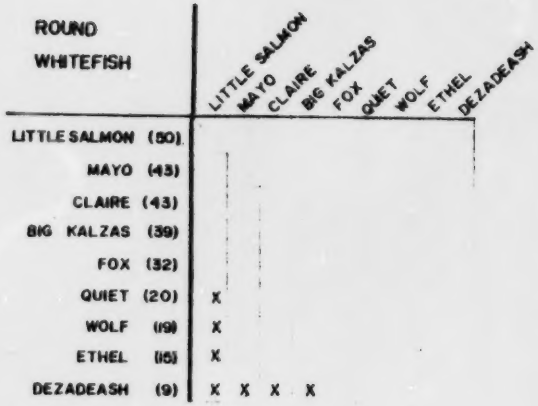
the age classes.

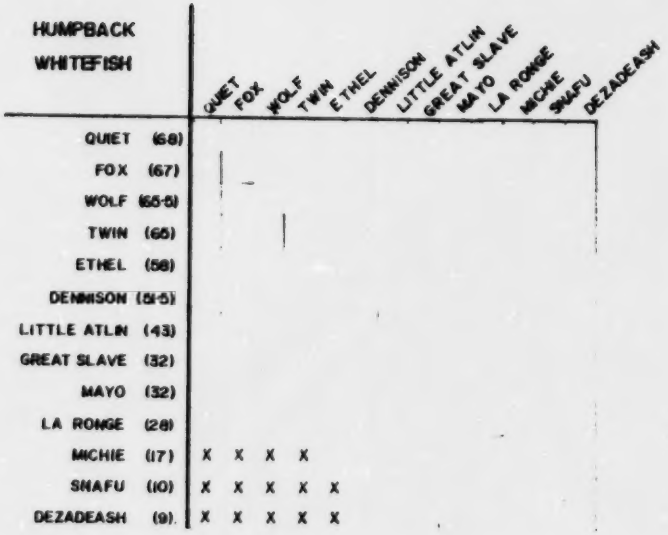
Grand rankings of lakes by species appear in Table 41. When examining all the species together it can be noted that Jojo Lake ranked the lowest for both trout and grayling with Dezadeash ranking the lowest for the whitefish species. All other lakes when ranked low in one species generally ranked high in another. For example, both Fox and Twin Lakes faired poorly against other lake trout lakes but did well when considering the humpback whitefish populations. This would seem to suggest that while some lakes are more productive for some species than others, there are also lakes which are slow producers overall, regardless of the species.

In an attempt to determine whether significant differences occurred between the growth patterns of certain species from one lake to another, the "Distribution-Free Test (Friedman, Kendall and Babington Smith)" was performed. (Hollander and Wolf 1973).

This test compared the populations of lake trout, humpback whitefish, round whitefish and Arctic grayling from lakes noted in Table 41. For comparative purposes, age-weight data from different areas of Canada were also incorporated in the analysis of humpback whitefish. This information originated from Lac La Ronge, Saskatchewan (Chen 1976), Great Slave Lake, Northwest Territories (Moshenko and Low 1977) and Dennison Lake, Manibota (Lysack 1982). In order to compensate for missing data and/or severely anomolous mean weights, it was necessary to estimate some values utilizing natural log equations developed from the age-weight relationships of specific cases. However, the use of calculated data was kept to a minimum recognizing the shortfalls of depending on such







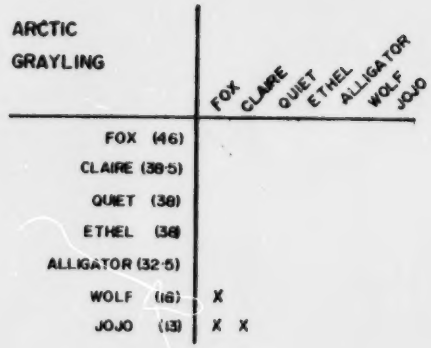


Table 41. Comparisons of overall growth rates (by weight) for species indicated. Significant differences at the 0.05 level are indicated by X. Grand ranks, in brackets, indicate the sums of all age class rankings.

derived equations. Lakes with small sample sizes and/or frequently lacking data were rejected. Age classes included in the analyses were 6 to 20 years inclusive for lake trout, 5 to 10 for humpback whitefish, 3 to 8 for round whitefish and 1 to 8 for Arctic grayling.

On examining the grand ranks derived from age specific mean weights, significant differences in growth between lakes was detected by the Distribution-Free test for all species. The S' statistics obtained, following Hollander and Wolf (1973) for lake trout, humpback whitefish, round whitefish and Arctic grayling were 32.3, 64.5, 38.0 and 23.3 respectively. These values established the presence of significant differences at the 0.001 level (Hollander and Wolf 1973).

Upon confirming the presence of significant differences in growth rates among the lakes examined, the "Distribution-Free Multiple Comparisons Test" (Hollander and Wolf 1973) was then performed to determine exactly which lakes supported differing populations. The results of this test for lake trout, which encompassed 8 Yukon lakes, are summarized in Table 41. Mean weight data for lake trout in Lac La Ronge (Chen 1979) was reviewed but not incorporated in the calculations as they were obviously different from the Yukon values with the mean weight up to 10 times greater in some age classes.

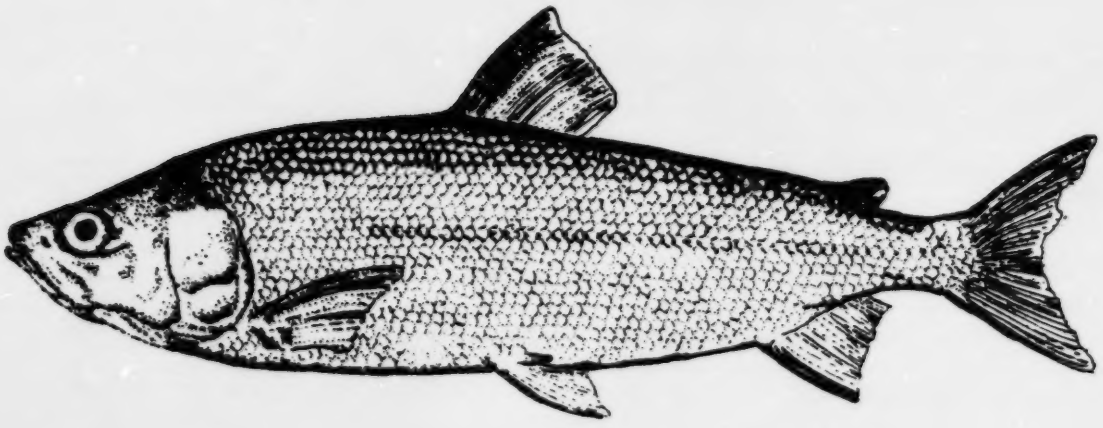
Understandably lakes with the greatest spread between their grand ranks were the ones found to have significant differences in their growth rates. The trout from Jojo Lake were found to differ from Coghlan, Claire and Alligator while those in Fox Lake were found to differ from Coghlan only. All other lakes were found to have

similar growth rates.

More differences were found on examination of humpback whitefish. Again, it was the lakes with the lowest grand ranks that differed significantly from those with the highest (Table 41). The values for humpback whitefish in Great Slave Lake, Dennison Lake and Lac La Ronge (Moshenko and Low 1977; Lysack 1982; Chen 1976), which were included in the assessment, showed no significant differences from any Yukon lakes, and fit in the middle of the ranking list.

Significant differences in round whitefish growth can be seen primarily among the populations of two lakes. Both Little Salmon, (which ranked highest) and Dezadeash (ranked lowest), were found to differ from four other lakes (Table 41).

Few differences were seen among the seven lakes where Arctic grayling populations were examined. Jojo was found to differ from Fox and Claire, with Wolf differing from Fox only (Table 41).



LEAST CISCO *Coregonus sardinella*

5. CONCLUSIONS AND RECOMMENDATIONS

Preliminary indications from Shortreed and Stockner (1983) suggest that the Morphoedaphic Index (M.E.I.) can generally be applied as a yield predictor in Yukon lakes.

Total fish yield estimates have been previously compiled by Horler (in prep.) for the lakes encompassed by this study. By applying the species composition data obtained in the present study to these estimates, it is possible to develop guideline harvest levels for the major target species. To this end, recommended quotas for individual lakes are presented in Table 42. With the exception of Little Atlin Lake, the summer species composition values were used in developing these quotas because of the greater species diversity in lakes during this season. Theoretical yields were developed by combining the individual species composition and fish yield data and subsequently adjusted to provide guideline harvest levels.

Two basic reasons prompted the reduction of the theorectical yields. Firstly, although previously stated that the use of the M.E.I has general application in Yukon lakes, there are indications that the north temperate model may overestimate Yukon fish yields (Horler in prep; Shortreed and Stockner 1983). Secondly, results from the 1980 National Sport Fishing Survey have shown that a substantially large portion of the overall catch is released. Therefore, in light of the possibility that the M.E.I overestimates fish yield and the likelihood that catch and release mortality is an important consideration, the theoretical yields were reduced by a factor of 0.35. However, there still remains an obvious need to qualify this factor in future investigations.

Due to the apparent vulnerability of lake trout to overfishing,

primarily as a result of slow growth rates, late age at maturity and low reproductive potential, it is recommended that a lake management strategy be developed which gives priority to this species. Of the 16 lakes listed in Table 42, six road access and four fly-in lakes have suggested lake trout harvest levels of less than 1000 kg/yr. The former group includes: Mayo, Quiet, Snafu, Fox, Twin and Taye lakes, whereas Alligator, Claire, Jojo and Michie lakes comprise the latter. Due to the relatively low allowable harvest levels, all of these lakes are therefore worthy of moderately intensive catch monitoring. Those lakes supporting harvests of less than 500 kg/yr may be best suited to catch and release fisheries only. Although catch and release mortality is presently poorly understood, an explanation of proper fish handling techniques through public information and education programs could go a long way in reducing the level of hook mortality. Such a program would also seem extremely beneficial as a means to reveal some of the mysteries and problems of northern fisheries management in general.

For lakes where little or no information presently exists, average fish yield and species composition values can be used to provide interim harvest levels until more information is collected. For example, the average fish yield as determined by Horler (in prep.) from the M.E.I. of 67 Yukon lakes is 3.45 kg/ha. From the present study, the average species composition by weight is 33.7% lake trout (summer value). However, this value is seriously affected by the data from Jojo and Alligator lakes which had unusually high lake trout catches and by Taye Lake which yielded no Lake trout. In order to compensate for these anomolies, the species composition data for these lakes is discarded giving a new adjusted mean of 24% lake

TABLE 42. Suggested guideline harvests for lake trout, northern pike and Arctic grayling in 16 Yukon lakes based on total yeild (all species) estimates (Horler, in prep.) and current species composition data.

LAKE	ESTIMATED TOTAL ANNUAL YIELD (kg)(A)	SPECIES COMPOSITION %(B)			THEORETICAL YIELD (kg)(C)			GUIDELINE ALLOWABLE HARVEST (kg)(D)		
		LAKE TROUT	NORTHERN PIKE	ARCTIC GRAYLING	LAKE TROUT	NORTHERN PIKE	ARCTIC GRAYLING	LAKE TROUT	NORTHERN PIKE	ARCTIC GRAYLING
Alligator	1893	70.7	N/A	29.3	1338	N/A	555	870	N/A	361
Big Kalzas	5444	58.4	5.7	0.4	3179	310	22	2067	202	14
Claire	4529	30.1	34.6	20.0	1363	1567	906	886	1019	589
Dezadeash	37290	49.3	2.3	N/A	18384	858	N/A	11950	558	N/A
Ethel	10122	15.6	10.6	5.1	1579	1073	516	1026	697	335
Fox	5627	18.5	6.0	12.9	1041	338	726	677	220	472
Jojo	888	87.0	N/A	13.0	773	N/A	115	502	N/A	75
Little Atlin	17661	13.1(E)	13.9(E)	N/A	2314	2455	N/A	2755	1596	N/A
Little Salmon	9377	36.4	4.8	N/A	3413	450	N/A	2219	293	N/A
Mayo	15660	4.9	N/A	N/A	767	N/A	N/A	499	N/A	N/A
Michie	1463	19.4	16.2	N/A	284	237	N/A	184	154	N/A
Quiet	7409	18.1	N/A	13.0	1341	N/A	963	872	N/A	626
Snafu	1752	3.3	53.2	N/A	58	932	N/A	38	606	N/A
Taye	5842	N/A	100	N/A	N/A	5842	N/A	N/A	3797	N/A
Twin	707	30.0	38.2	N/A	212	270	N/A	138	176	N/A
Wolf	13818	35.2	2.9	10.3	4864	401	1423	3162	261	925

(A) from Horler (in prep.) - all species
(B) from 1982-83 summer field programs - present study
(C) A x B
(D) C x 0.65 = compensation factor for probable tendency of MEI to overestimate yield and allowance for catch and release hook mortality
(E) from 1983 winter field program - present study

trout. This percentage can be applied to the 3.45 kg/ha/yr average to develop lake trout harvest levels which should then also be reduced by 35% for reasons outlined previously.

This study has provided a base from which future management strategies for the fisheries resources of Yukon lakes can be developed. Northern fish populations are characterized by relatively low productivity and species diversity and in some cases slow growth rates. These factors alone suggest that exploitation of the fisheries resource should be closely monitored through annual questionnaires, creel census and/or other methods, in order to prevent serious declines in stock levels. Particular attention should be given to lake trout, Arctic grayling, northern pike, and humpback whitefish which are the primary target species of the subsistence, sport, domestic and commercial fisheries. Harvest levels should be implemented to ensure that catches do not exceed the productive capacity of individual lakes.

Additional life history studies and research to further qualify the M.E.I., and other fish yield estimators, are required in order to better understand the limits of production not only for lake trout but for the other species as well. Furthermore, comprehensive analysis of egg to juvenile survival and early growth patterns is needed prior to any contemplation of enhancement.

Decreasing catch trends combined with increasing demand necessitate immediate implementation of the proposed management strategy to ensure the continued existence of this valuable yet limited resource.

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APPENDICES

Appendix A.

Summary of netting activity during summer programs, 1982-83.

Appendix A. Summary of netting activity during summer programs, 1982-83.

LAKE	NET SET	NET TYPE	HRS. OF SET	DEPTH AT END OF NET (m)	DATE	COMMENTS
ALLIGATOR	A	float	13	7.2	29/07/82	Rocky shore with bolder bottom. Gradual slope down from shore. No vegetation.
		sink	13	7.2	29/07/82	
	B	float	13	7.2	26/08/82	Rocky shore with bolder bottom. Gradual slope down from shore. No vegetation.
		sink	13	7.2	26/08/82	
BIG KALZAS	A	float	13	23.0	31/07/83	Rocky bottom, no vegetation quick drop off
		sink	12 3/4	30.3	31/07/83	
	B	float	13 1/2		01/08/83	Rocky bottom with sand, sporatic vegetation.
		sink	13		01/08/83	
CLAIRE	A	float	14	21.4	28/07/83	Pebble bottom with no vegetation becoming sand 8 m from shore.
		sink	14 1/2	18.1	28/07/83	
	B	float	13	24.0	29/07/83	Rock bottom, little vegetation, quick drop off.
		sink	12 1/2	32.0	29/07/83	
DEZADEASH	A	float	74	5.8	18/08/83	Pebbles going to sand with little or no vegetation.
		sink	72	6.5	18/08/83	
	B	N/A				
ETHEL	A	float	15	33.4	10/08/82	Rocky shore with cobble bottom, dropping off quickly.
		sink	15	33.4	10/08/82	
	B	float	13	20.1	11/08/82	Rocky shoreline with sandy bottom and little vegetation. Gradual incline.
		sink	13	20.1	11/08/82	
FOX	A	float	16	10.0	07/07/82	Cobble near shore, soon turning to silt. Varied sparse to high density vegetation.
		sink	16	18.2	07/07/82	
	B	float	19	33.4	13/07/82	Cobble leading to silt with sparse vegetation. Quick drop off.
		sink	19	33.4	13/07/82	

Appendix A. Continued.

LAKE	NET SET	NET TYPE	HRS. OF SET	DEPTH AT END OF NET (m)	DATE	COMMENTS
JOJO	A	float	14	-	03/08/83	Large cobble, sharp drop off.
		sink	14	-	03/08/83	
	B	float	16	-	04/08/83	Silt with some vegetation gradual incline with rise at end of nets to approx. 5 m.
		sink	16	-	04/08/83	
LITTLE ATLIN	A	float	13	3.4	22/07/82	Rocky shoreline, cobble going to sand with sparse vegetation and gradual drop off.
		sink	13	3.4	22/07/82	
	B	float	14	10.0	30/08/83	Cobble with sparse vegetation.
		sink	14	10.0	30/08/83	
LITTLE SALMON	A	float	14	-	18/08/82	Rocky area, no vegetation.
		sink	14	-	18/08/83	
	B	float	15	-	19/08/82	Large rocks, no vegetation.
		sink	15	-	19/08/82	
MAYO	A	float	13 1/2	5.0	09/08/83	Float set 20 m from shore sink set 25 m due to standing dead trees at shore.
		sink	13 1/2	5.0	09/08/83	
	B	float	13	12.0	10/08/83	
		sink	12 1/2	14.0	10/08/83	
MICHIE	A	float	13	-	28/07/83	Minimal vegetation, cobbles and rocks.
		sink	13	-	28/07/83	
	B	float	13	-	29/07/83	Minimal vegetation, cobbles and rocks.
		sink	13	-	29/07/83	
QUIET	A	float	15	33.4	20/07/83	Rocky bottom near shore, no vegetation, quick drop off.
		sink	14 1/2	33.4	20/07/83	
	B	float	14 1/2	27.2	21/07/83	Gradual drop off.
		sink	14	29.0	21/07/83	

Appendix A. Continued.

LAKE	NET SET	NET TYPE	HRS. OF SET	DEPTH AT END OF NET (m)	DATE	COMMENTS
SNAFU	A	float	12	-	20/07/82	Rock and sand bottom with
		sink	12	-	20/07/82	gradual drop, sparse vegetation.
	B	float	14	-	21/07/82	Sink set in salty bottom,
		sink	14	-	21/07/82	no vegetation and quick drop off. Float set in same bottom type but more gradual drop.
TAYE	A	float	14	3.1	23/08/82	Rocky shore, mild silt starting 3 m from shore, excessive vegetation.
	B	float	15	3.1	24/08/82	Rocky shore, mild silt starting 3 m from shore, excessive vegetation.
TWIN	A	float	12	-	15/07/82	Some rocks, silt bottom,
		sink	12	-	15/07/82	sparse vegetation. Drop off 10 m from shore.
	B	float	12	-	16/07/82	Cobble, small amounts of
		sink	12	-	16/07/82	silt and vegetation, drop off 5 m from shore.
WOLF	A	float	12 1/2	8.0	06/08/83	Cobble stone to silt,
		sink	13	8.0	06/08/83	sparse vegetation.
	B	float	12	4.0	07/08/83	Cobble stone, dense
		sink	12	21.0	07/08/83	vegetation near shore.

Appendix B.

Summary of netting activity during winter program, 1983.

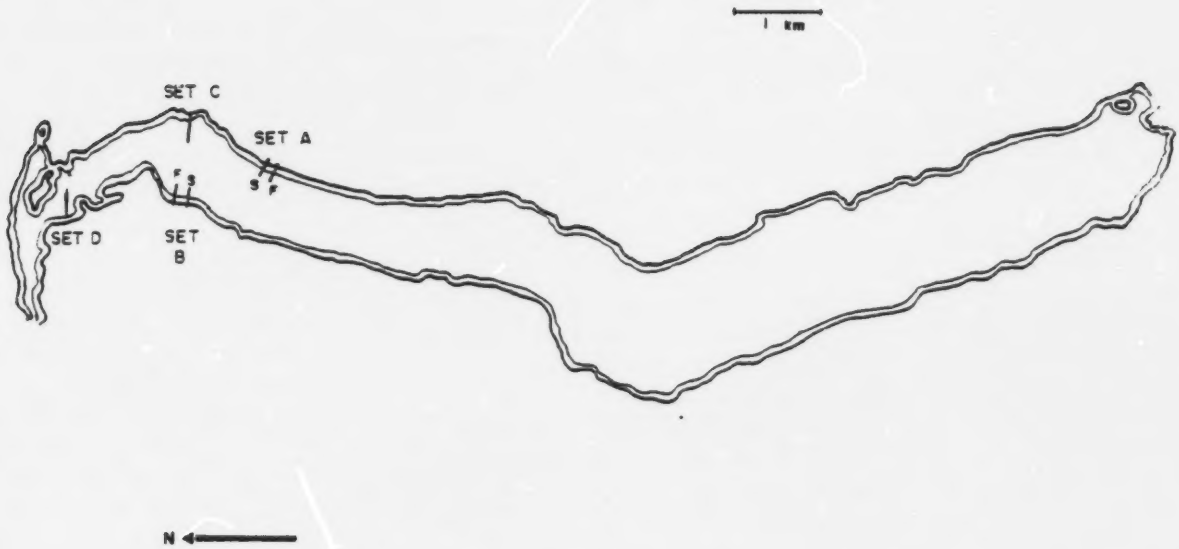
Appendix 8. Summary of netting activity during winter program, 1983.

LAKE	NET SET	NET TYPE	HRS. OF SET	DEPTH AT END OF NET (m)	DATE	COMMENTS
Alligator	C	sink	18 3/4	5.0	10/03/83	Ice 7 cm., snow 25 cm.
	D	sink	17	7.8	11/03/83	Snow 27 cm., ice 80 cm.
CLAIRE	C	sink	69	42.0	20/03/83	Snow 25 cm., ice 60 cm.
	D	sink	64	33.0	21/03/83	Snow 28 cm., ice 60 cm.
Coghlan	C	sink	22	10.5	14/03/83	Snow 21 cm., ice 79 cm.
	D	sink	21 1/2	20.0	15/03/83	
FOX	C	sink	43	11.0	19/03/83	Snow 18 cm., ice 88 cm.
	D	sink	19	12.0	20/03/83	
JOJO	C	sink	19 1/2	11.0	12/03/83	Snow 10 cm., ice 1.2 cm.
	D	N/A				
LITTLE ATLIN	C	sink	47	10.0	24/03/83	Ice 75 cm.
	D	sink	44	10.0	25/03/83	Ice 75 cm.
LITTLE SALMON	C	sink	45	20.0	22/03/83	Ice 1.0 m
	D	N/A				
MICHIE	C	sink	40	9.0	21/03/83	
	D	sink	37 1/2	13.0	13/03/83	Ice 50 cm., snow 33 cm.
QUIET	C	sink	42	13.0	14/03/83	Snow 40 cm., ice 51 cm.
	D	sink	41	10.6	15/03/83	
SEKULMUN	C	sink	18	19.0	14/03/83	Snow 10 cm., ice 1.2 m.
	D	sink	17 1/2	11.0	15/03/83	Snow 10 cm., ice 1.2 m.
TWIN	C	sink	40	20.0	20/03/83	Snow 24 cm., ice 67 cm.
	D	sink	38	19.0	21/03/83	Snow 30 cm., ice 56 cm.

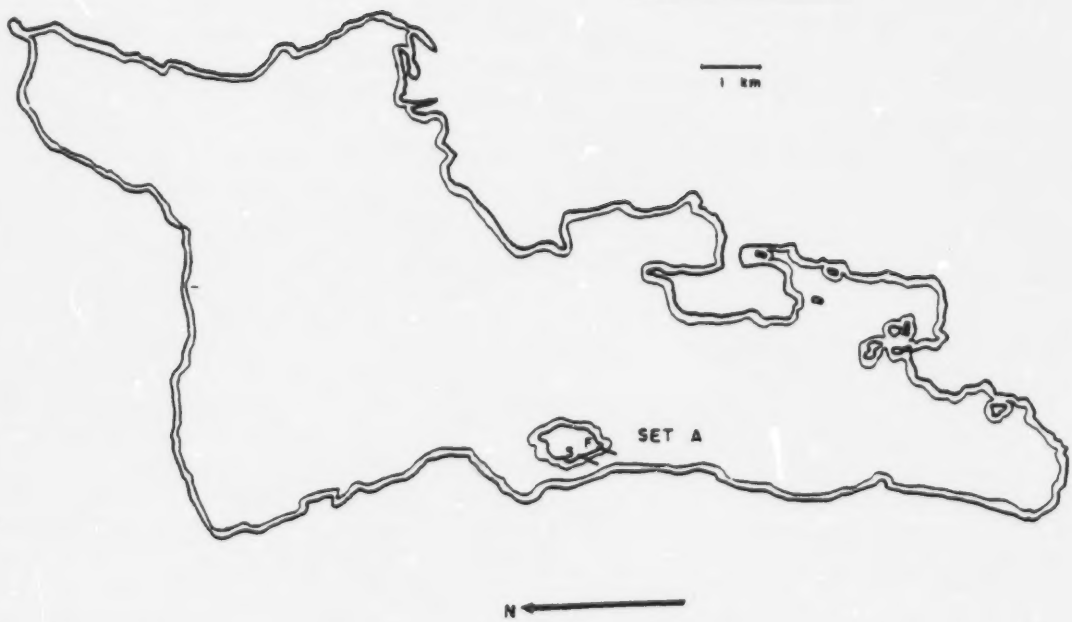
Appendix C.

Location of seine and gill nets used in the current study.

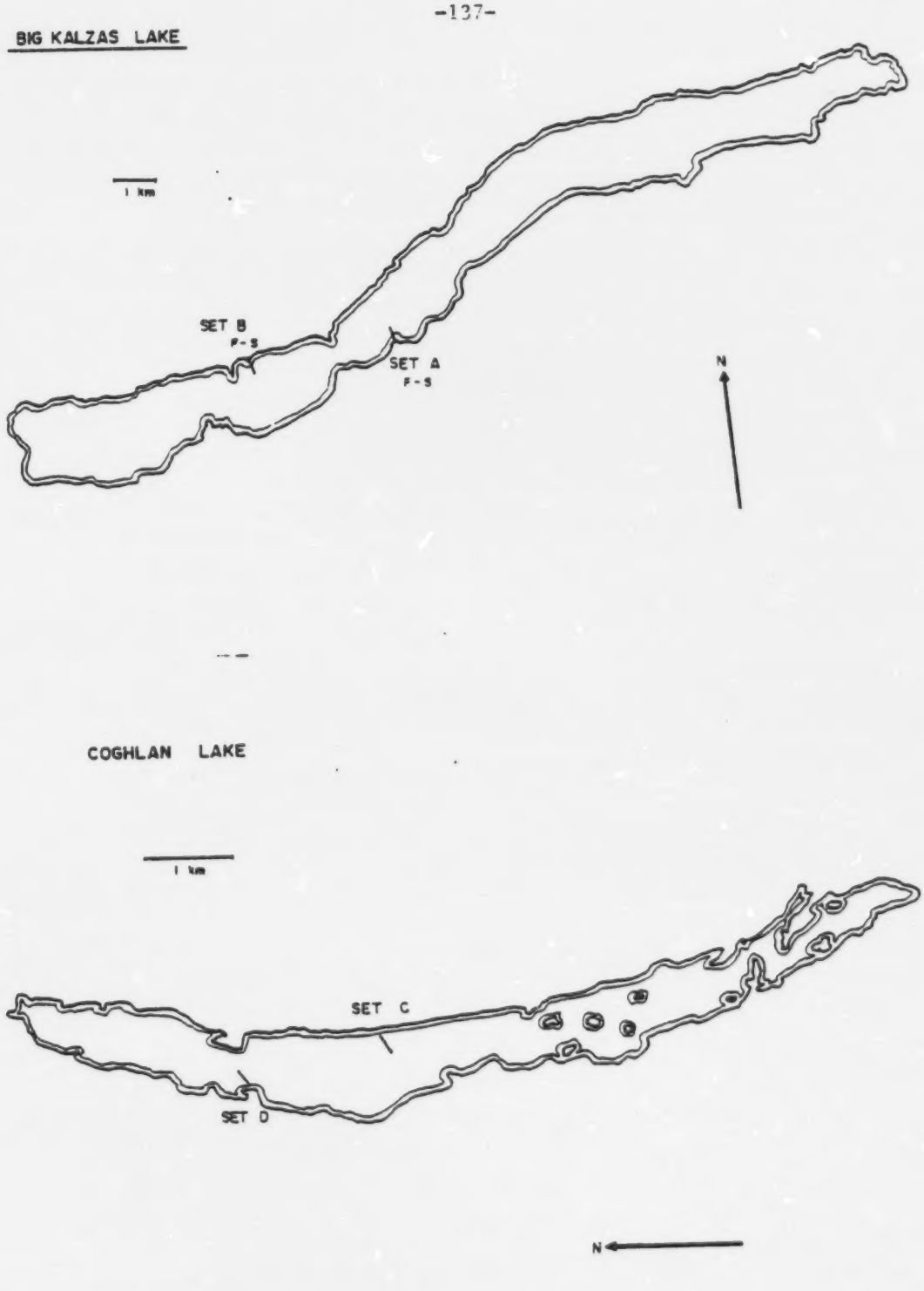
CLAIRE LAKE (SOUTH)



DEZADEASH LAKE

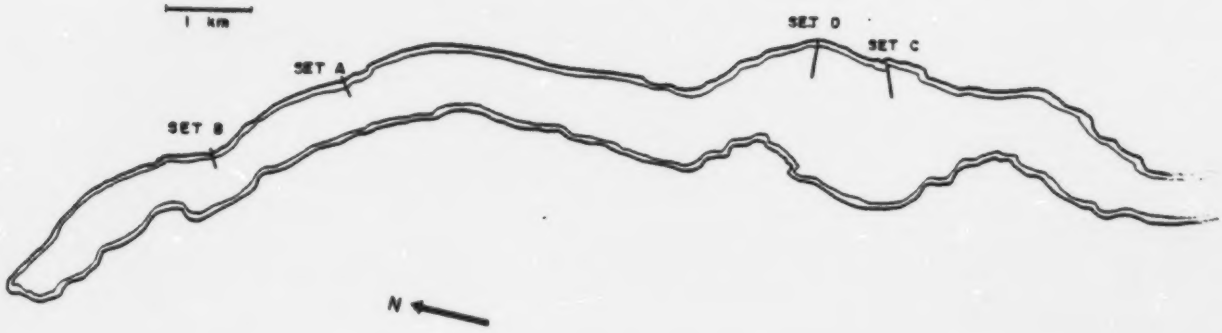


Location of gill nets used in current study

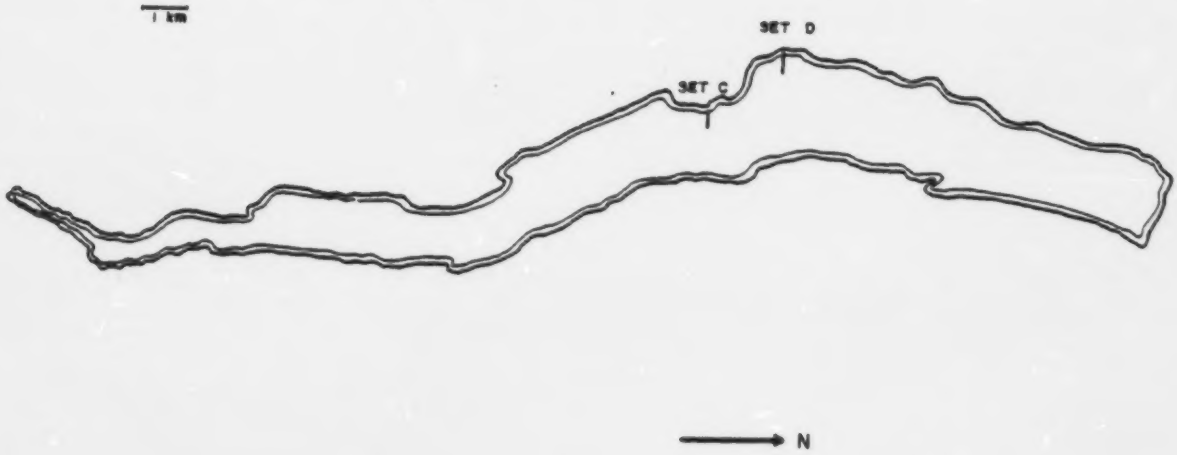


Location of gill nets used in current study

QUIET LAKE

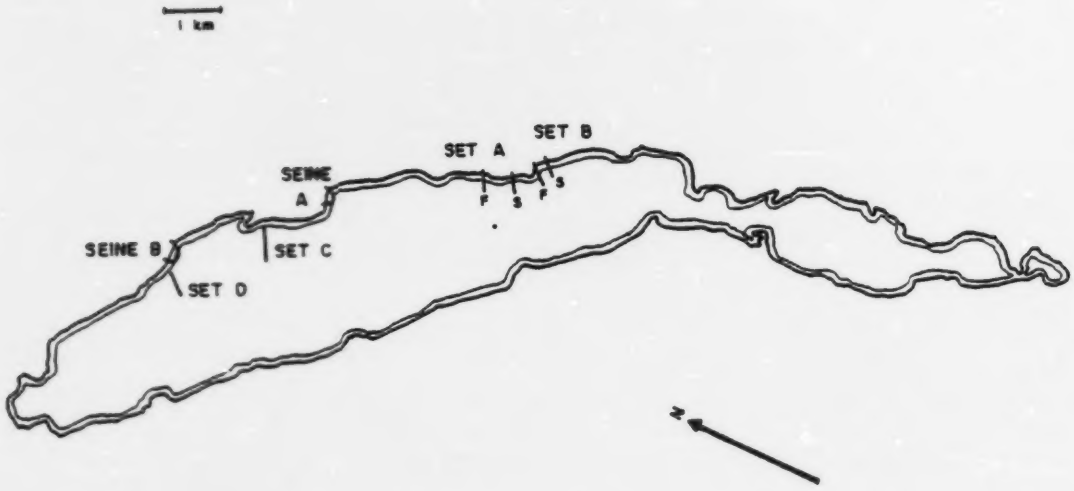


SEKULMAN LAKE

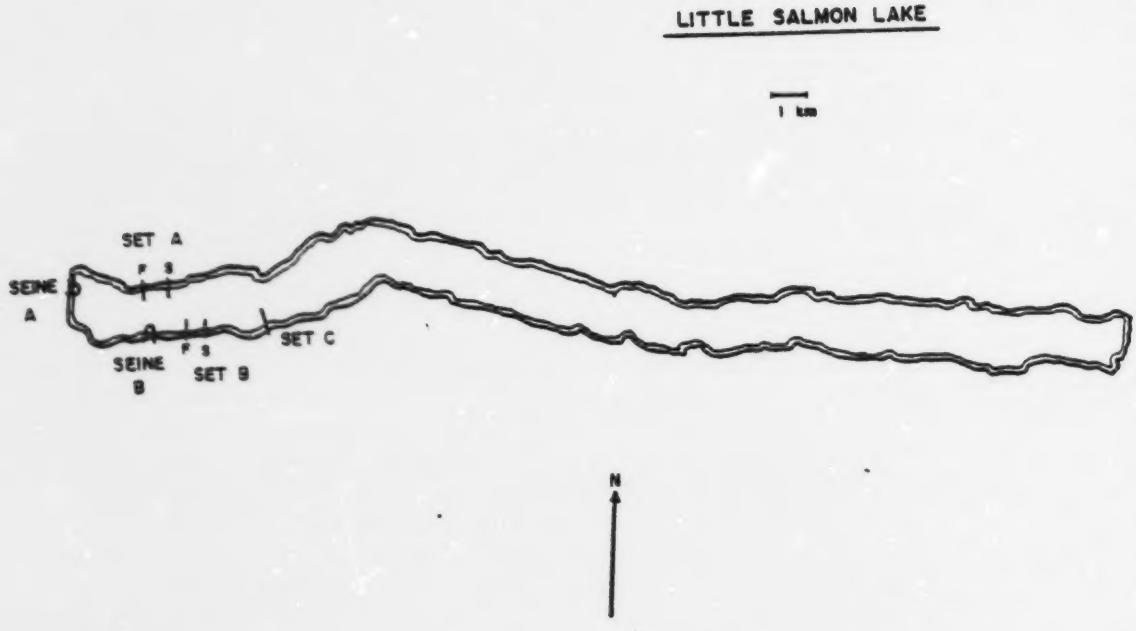


Location of gill nets used in current study

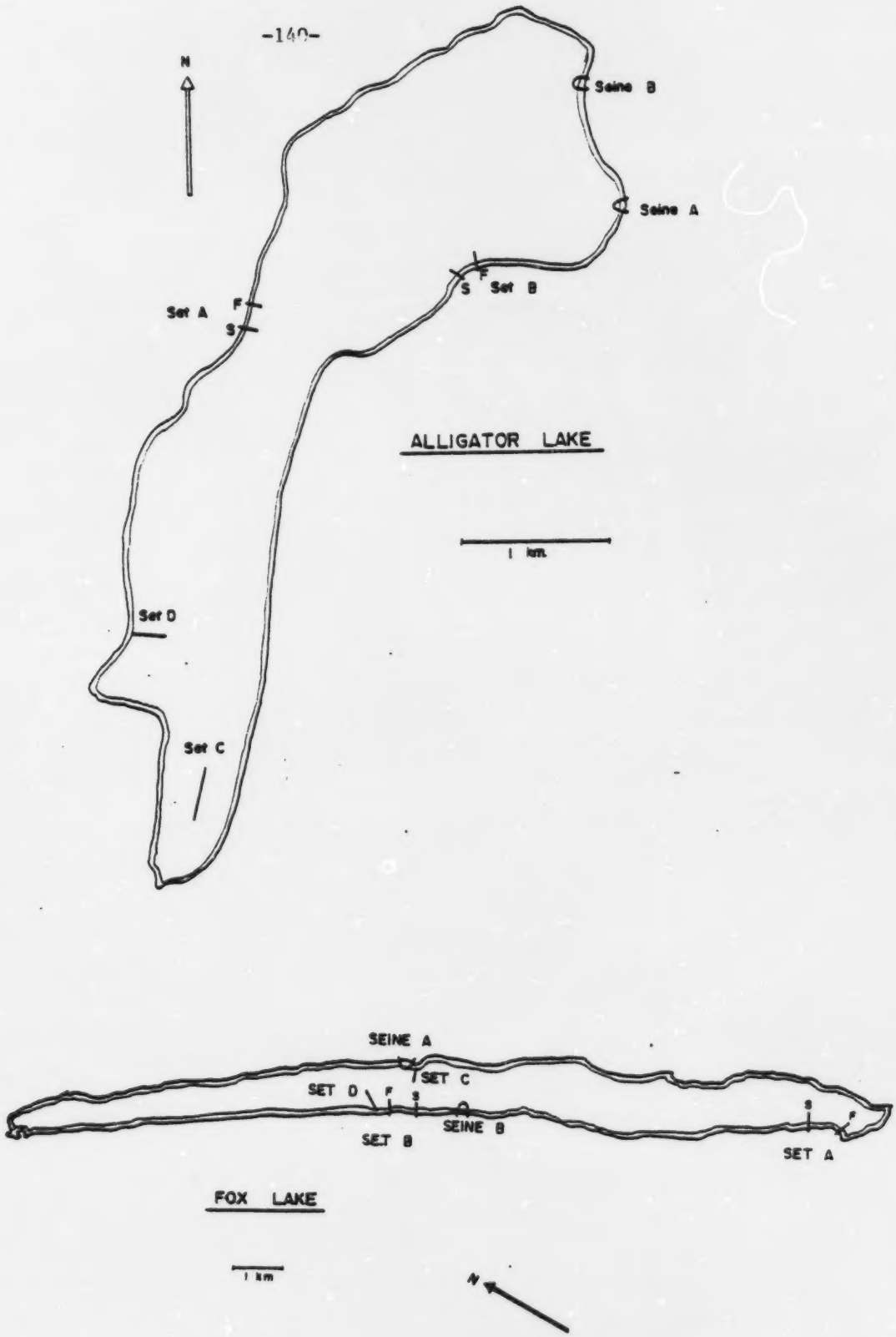
LITTLE ATLIN LAKE



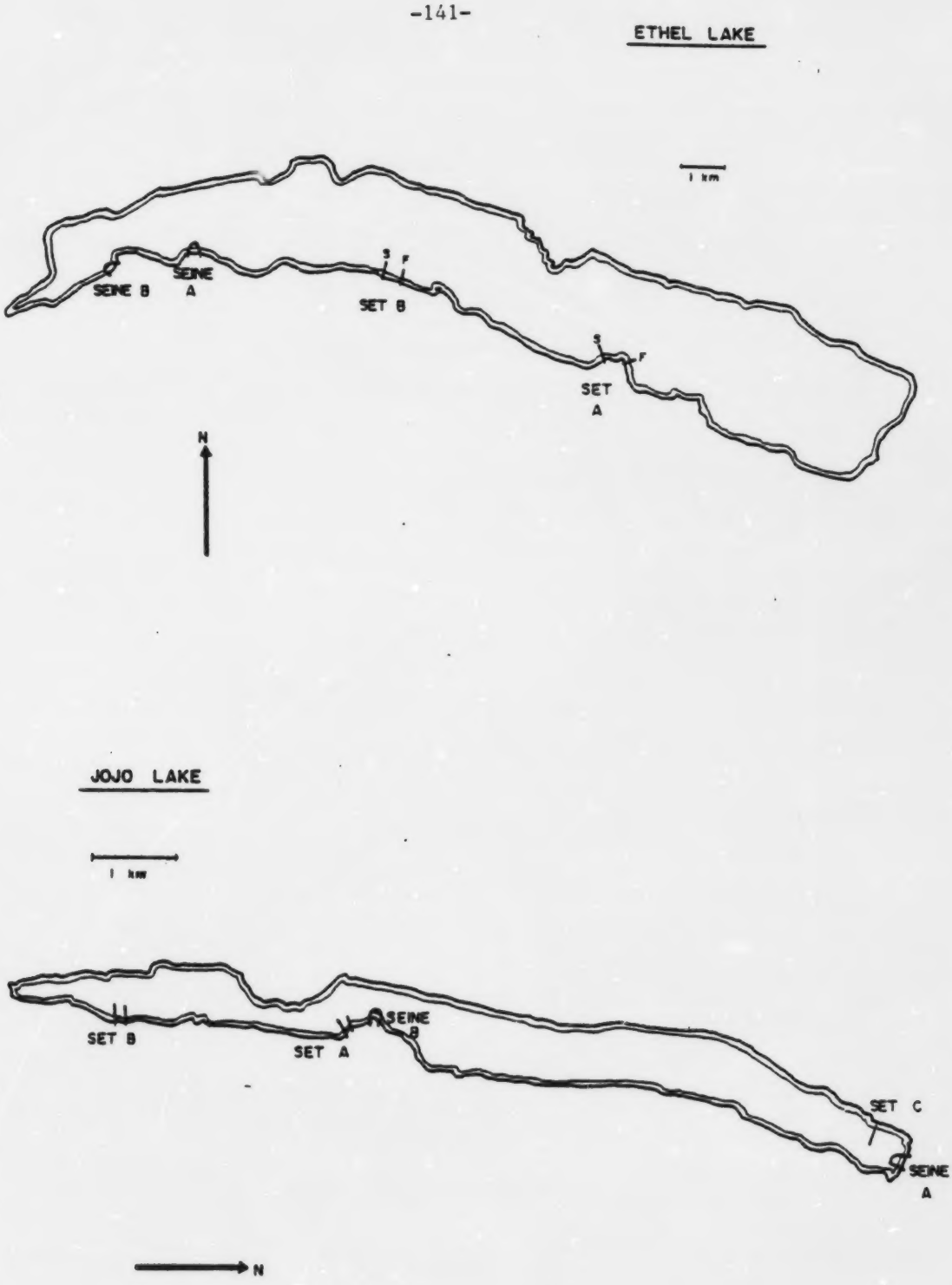
LITTLE SALMON LAKE



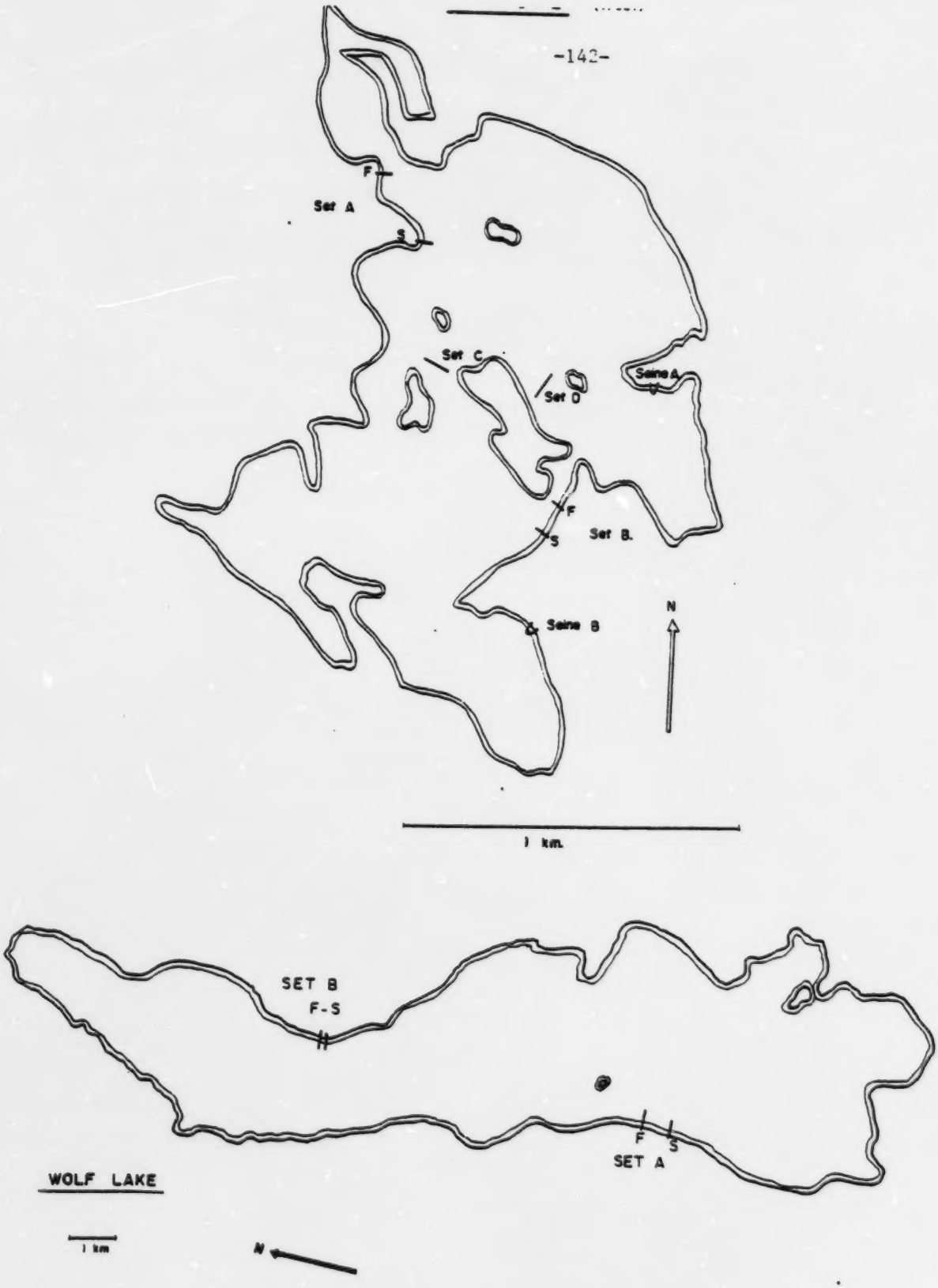
Location of seine and gill nets used in current study.



Location of seine and gill nets used in current study.

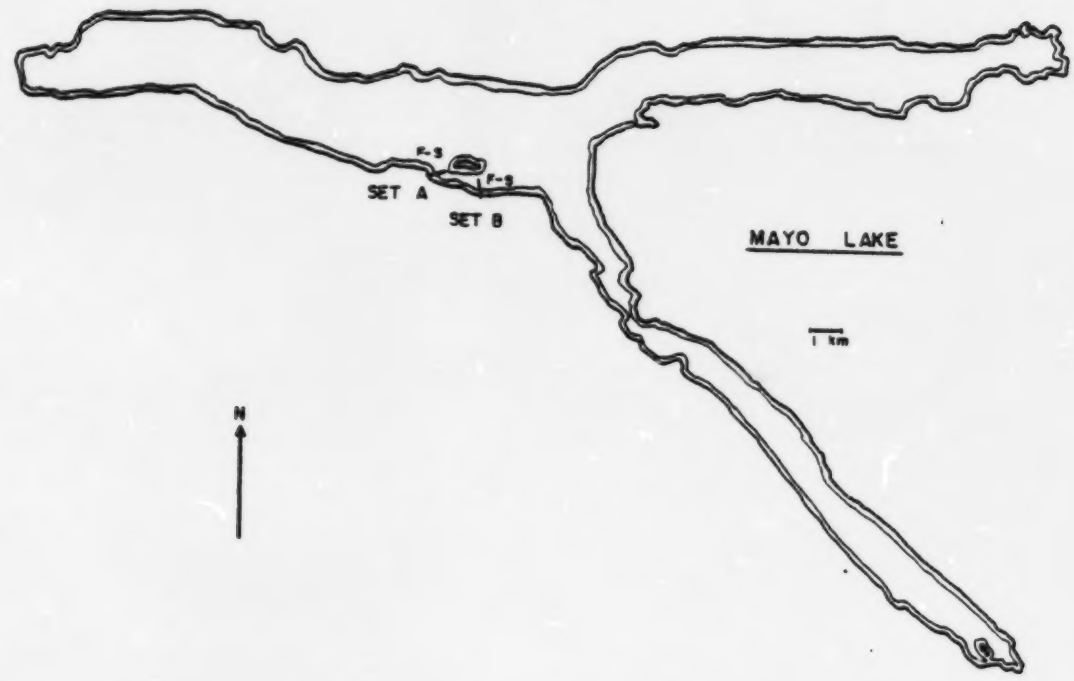


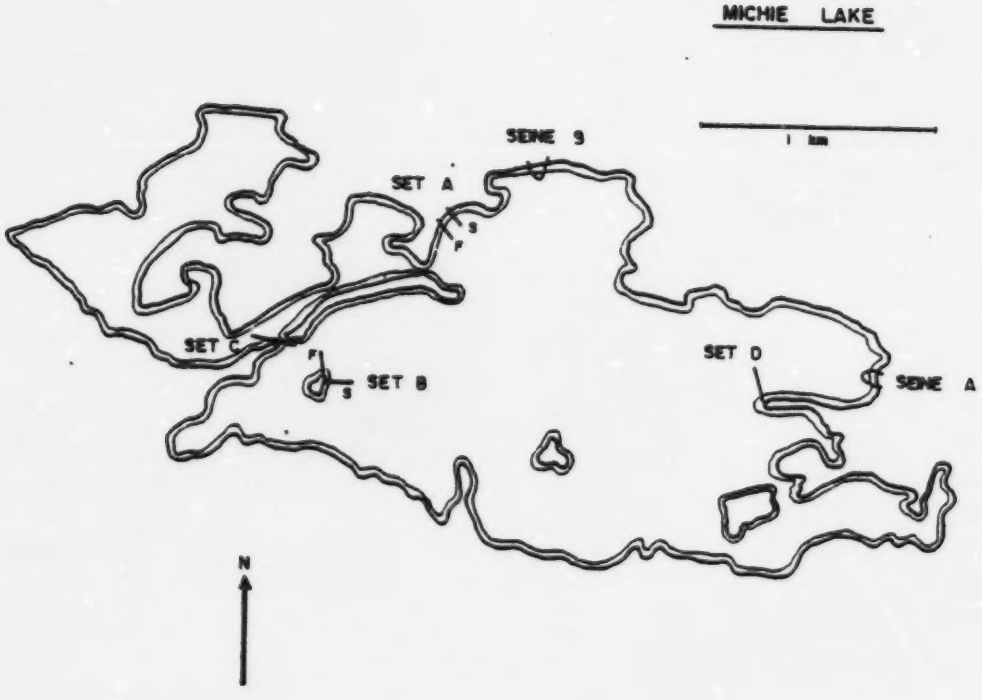
Location of seine and gill nets used in current study.



Location of seine and gill nets used in current study.

Location of seine and gill nets used in current study.





Location of seine and gill nets used in current study.

Appendix D.

Length, weight and K-values by age class for :

1 - Lake trout.

2 - Pike.

3 - Least cisco.

4 - Grayling.

5 - Humpback whitefish.

6 - Round whitefish.

7 - Broad whitefish.

8 - Burbot.

Appendix D. Length, weight and K-value for lake trout by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
QUIET	4	1	176	-	-	60	-	-	1.10	-	-
	5	3	212	31.2	193-248	107	63.7	65-180	1.03	0.14	0.90-1.18
	6	0	-	-	-	-	-	-	-	-	-
	7	1	252	-	-	170	-	-	1.06	-	-
	8	1	284	-	-	230	-	-	1.00	-	-
	9	1	323	-	-	310	-	-	0.92	-	-
	10	1	300	-	-	275	-	-	1.02	-	-
	11	2	310	3.5	307-312	310	14.1	300-320	1.05	0.01	1.04-1.0[illegible]
	12	3	384	57.8	330-445	587	254.0	540-861	0.99	0.01	0.98-1.0[illegible]
	13	2	438	9.9	431-445	825	35.4	800-850	0.98	0.03	0.96-1
	14	3	451	58.1	384-482	978	301.0	635-1200	1.05	0.09	0.05-1
	15	5	430	21.5	392-442	873	94.8	750-1000	1.11	0.24	0.87-1.49
	16	1	389	-	-	630	-	-	1.07	-	-
	17	1	609	-	-	3129	-	-	1.39	-	-
	18	1	558	-	-	1590	-	-	0.92	-	-
	19	1	400	-	-	720	-	-	1.12	-	-
ALLIGATOR	6	3	187	37.2	155-228	80	39.7	50-125	1.17	0.15	1.05-1.34
	7	4	297	63.6	237-376	360	213.0	150-640	1.29	0.42	0.89-1.88
	8	8	354	42.1	300-433	585	187.0	350-900	1.29	0.14	1.11-1.48
	9	8	373	30.3	341-432	739	260.0	430-1300	1.38	0.16	1.08-1.61
	10	13	393	21.8	340-425	848	174.0	487-1200	1.28	0.16	1.23-1.77
	11	7	407	23.6	386-436	932	174.0	800-1300	1.23	0.19	1.33-1.86
	12	5	397	12.0	386-411	875	150.0	725-1100	1.14	0.15	1.26-1.61
	13	8	412	12.4	393-430	1055	128.0	887-1230	1.35	0.16	1.29-1.76
	14	12	414	155.0	382-434	924	137.0	742-1200	1.30	0.18	1.04-1.62
	15	6	426	51.1	373-510	964	257.0	550-1250	1.33	0.34	0.90-1.85
	16	1	394	-	-	850	-	-	1.39	-	-
	17	2	437	11.3	429-445	995	7.1	990-1000	1.19	0.11	1.12-1.27
	18	6	430	46.4	408-525	1025	165.0	700-1150	1.33	0.35	0.76-1.61
	19	7	416	17.4	393-446	1024	112.0	850-1150	1.42	0.11	1.24-1.57
	20	7	417	9.8	403-434	1050	270.0	774-1500	1.50	0.30	1.18-2.04
	21	9	431	18.7	406-460	1100	180.0	850-1400	1.36	0.25	1.01-1.89
	22	5	441	33.4	406-486	1150	305.0	900-1600	1.32	0.05	1.24-1.39
	23	8	423	11.9	411-443	957	163.0	850-1250	1.31	0.24	1.04-1.66
	24	4	419	19.0	392-436	1159	356.0	900-1636	1.35	0.28	1.36-1.97
	25	3	438	18.7	417-452	1117	275.0	800-1300	1.31	0.18	1.10-1.41
	26	1	432	-	-	900	-	-	1.12	-	-
	27	3	417	17.0	398-431	967	126.0	850-1100	1.36	0.14	1.19-1.46
	28	0	-	-	-	-	-	-	-	-	-
	29	2	374	55.8	334-413	775	338.0	500-1050	1.42	0.11	1.34-1.49
	30	4	428	34.1	395-462	1094	320.0	825-1500	1.37	0.10	1.30-1.52
	31	2	441	16.3	429-452	1087	53.7	1049-1125	1.28	0.08	1.22-1.33
	32	0	-	-	-	-	-	-	-	-	-
	33	0	-	-	-	-	-	-	-	-	-
	34	0	-	-	-	-	-	-	-	-	-
	35	0	-	-	-	-	-	-	-	-	-
	36	1	802	-	-	7700	-	-	1.49	-	-
SEKULMUN	7	1	313	-	-	362	-	-	1.18	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	1	318	-	-	317	-	-	0.99	-	-
	14	0	-	-	-	-	-	-	-	-	-
	15	1	523	-	-	1814	-	-	1.27	-	-
	16	0	-	-	-	-	-	-	-	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	4	538	25.9	513-570	1817	156.7	1675-2000	1.20	0.15	1.08-1.41
	19	0	-	-	-	-	-	-	-	-	-
	20	0	-	-	-	-	-	-	-	-	-
	21	0	-	-	-	-	-	-	-	-	-
	22	0	-	-	-	-	-	-	-	-	-
	23	0	-	-	-	-	-	-	-	-	-
	24	1	565	-	-	2500	-	-	1.39	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	0	-	-	-	-	-	-	-	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	0	-	-	-	-	-	-	-	-	-
	30	0	-	-	-	-	-	-	-	-	-
	31	0	-	-	-	-	-	-	-	-	-
	32	0	-	-	-	-	-	-	-	-	-
	33	0	-	-	-	-	-	-	-	-	-
	34	0	-	-	-	-	-	-	-	-	-
	35	0	-	-	-	-	-	-	-	-	-
	36	1	602	-	-	3402	-	-	1.36	-	-

Appendix D. Length, weight and K-value for lake trout by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE
WOLF	6	1	403	-	-	730	-	-	1.1	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	1	438	-	-	1010	-	-	1.05	-	-
	11	4	435	88.6	327-544	1029	265.1	871-1425	1.41	0.78	0.89-2.57
	12	1	495	-	-	1415	-	-	1.17	-	-
	13	3	466	42.6	422-507	1150	330.9	850-1505	1.11	0.05	1.05-1.15
	14	1	582	-	-	2240	-	-	1.14	-	-
	15	1	649	-	-	2255	-	-	0.82	-	-
	16	0	-	-	-	-	-	-	-	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	0	-	-	-	-	-	-	-	-	-
	19	0	-	-	-	-	-	-	-	-	-
	20	1	518	-	-	1650	-	-	1.19	-	-
	21	1	454	-	-	1120	-	-	1.20	-	-
	22	0	-	-	-	-	-	-	-	-	-
	23	1	500	-	-	1460	-	-	1.17	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	2	513	37.5	486-539	1515	459.6	1190-1840	1.04	0.10	1.04-1.18
	26	0	-	-	-	-	-	-	-	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	1	688	-	-	4400	-	-	1.35	-	-
	29	0	-	-	-	-	-	-	-	-	-
	30	0	-	-	-	-	-	-	-	-	-
	31	0	-	-	-	-	-	-	-	-	-
	32	0	-	-	-	-	-	-	-	-	-
	33	1	444	-	-	943	-	-	1.08	-	-
TWIN WEST	6	2	181	4.2	178-184	41	21.9	25-56	0.70	0.42	0.40-0.99
	7	3	200	49.5	163-256	91	73.1	46-175	0.99	0.10	0.87-1.06
	8	4	207	27.1	180-242	88	59.5	25-165	0.91	0.37	0.35-1.16
	9	2	233	12.0	224-241	142	46.7	109-175	1.11	0.19	0.97-1.25
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	1	244	-	-	130	-	-	1.03	1.03	-
	13	4	421	77.9	352-495	1005	554.6	400-1500	1.24	0.24	0.92-1.49
	14	2	501	26.9	482-520	1708	272.2	1515-1900	1.35	-	1.35-1.35
	15	2	410	89.8	346-473	897	535.3	518-1275	1.23	0.04	1.20-1.25
	16	1	499	-	-	1300	-	-	1.05	-	-
	17	1	614	-	-	3300	-	-	1.43	-	-
	18	1	634	-	-	3200	-	-	1.26	-	-
	19	0	-	-	-	-	-	-	-	-	-
	20	0	-	-	-	-	-	-	-	-	-
	21	0	-	-	-	-	-	-	-	-	-
	22	1	643	-	-	4000	-	-	1.50	-	-
	23	1	580	-	-	3000	-	-	1.54	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	1	666	-	-	4320	-	-	1.46	-	-
BIG KALZAS	4	1	85	-	-	-	-	-	-	-	-
	5	0	-	-	-	-	-	-	-	-	-
	6	1	233	-	-	120	-	-	0.95	-	-
	7	2	224	12.73	215-233	120	14.1	110-130	1.07	0.06	1.03-1.11
	8	1	251	-	-	170	-	-	1.08	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	1	370	-	-	500	-	-	0.99	-	-
	12	4	408	21.01	384-435	713	132.5	580-850	1.04	0.13	0.94-1.23
	13	0	-	-	-	-	-	-	-	-	-
	14	1	469	-	-	1020	-	-	0.99	-	-
	15	3	420	91.51	316-487	945	535.4	350-1390	1.15	0.05	1.11-1.20
	16	1	470	-	-	1260	-	-	1.21	-	-
	17	1	445	-	-	995	-	-	1.13	-	-
	18	3	473	24.98	445-493	1150	95.4	1060-1250	1.09	0.10	1.02-1.20
	19	4	465	14.15	449-479	1085	183.1	960-1355	1.07	0.11	0.97-1.23
	20	2	467	5.66	463-471	1187	144.9	1085-1290	1.16	0.10	1.09-1.23
	21	1	492	-	-	1200	-	-	1.01	-	-
	22	3	477	17.58	464-497	1277	219.4	1150-1530	1.19	0.27	0.94-1.47
	23	0	-	-	-	-	-	-	-	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	1	515	-	-	1220	-	-	0.89	-	-
	26	1	455	-	-	1120	-	-	1.19	-	-

Appendix D1. Length, weight and K-value for lake trout by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
CLAIRE	5	1	174	-	-	70	-	-	1.33	-	-
	6	9	247	38.0	178-297	198	68.4	80-300	1.18	0.11	1.08-1
	7	6	254	52.4	187-344	166	54.6	82-231	1.09	0.34	0.39-1
	8	6	265	20.5	242-296	204	47.9	155-280	1.08	0.10	0.91-1
	9	3	328	75.9	245-394	442	293.8	165-750	1.12	0.12	1.0 -1
	10	4	348	30.4	309-380	481	151.8	315-675	1.11	0.04	1.0 -1
	11	5	372	21.3	344-404	638	133.9	460-835	1.22	0.05	1.13-1
	12	3	436	112.4	337-560	702	(1 Wt. used)	-	1.83	-	-
	13	4	393	28.9	375-436	743	103.8	654-890	1.23	0.10	1.07-1.31
	14	4	389	29.0	346-407	689	115.8	518-771	1.16	0.08	1.07-1.25
	15	1	368	-	-	628	-	-	1.26	-	-
	16	3	431	122.5	353-572	751	212.2	617-995	1.08	0.49	0.53-1.45
COGHLAN	6	1	231	-	-	150	-	-	1.22	-	-
	7	2	273	16.3	262-285	350	-	-	1.73	0.31	1.51-1.95
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	2	401	90.5	337-465	700	70.7	650-750	1.23	0.67	0.75-1.70
	11	0	-	-	-	-	-	-	-	-	-
	12	2	328	93.3	262-394	550	565.6	150-950	1.19	0.51	0.83-1.55
	13	2	405	53.7	367-443	975	318.2	750-1200	1.45	0.10	1.38-1.52
	14	0	-	-	-	-	-	-	-	-	-
	15	1	440	-	-	1250	-	-	1.47	-	-
	16	1	253	-	-	150	-	-	0.93	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	2	542	122.3	456-629	217	1025.3	1450-2900	1.35	0.25	1.17-1.53
	19	0	-	-	-	-	-	-	-	-	-
	20	1	452	-	-	1150	-	-	1.25	-	-
	21	0	-	-	-	-	-	-	-	-	-
	22	0	-	-	-	-	-	-	-	-	-
	23	0	-	-	-	-	-	-	-	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	0	-	-	-	-	-	-	-	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	0	-	-	-	-	-	-	-	-	-
	30	1	751	-	-	5400	-	-	1.27	-	-
	31	0	-	-	-	-	-	-	-	-	-
	32	0	-	-	-	-	-	-	-	-	-
	33	0	-	-	-	-	-	-	-	-	-
	34	0	-	-	-	-	-	-	-	-	-
	35	0	-	-	-	-	-	-	-	-	-
	36	1	750	-	-	5400	-	-	1.28	-	-
JOJO	4	1	166	-	-	52	-	-	1.14	-	-
	5	1	147	-	-	40	-	-	1.26	-	-
	6	1	227	-	-	112	-	-	0.96	-	-
	7	5	207	22.5	181-235	102	37.9	58-149	1.11	0.17	0.94-1.38
	8	3	231	28.6	208-263	97	50.3	50-150	0.76	0.28	0.46-1.01
	9	6	273	49.0	235-340	245	171.0	100-500	1.08	0.53	0.61-2.04
	10	8	270	47.4	225-356	210	186.0	50-600	0.88	0.32	0.39-1.33
	11	11	336	40.1	246-389	477	211.0	100-750	1.15	0.33	0.64-1.40
	12	20	349	40.4	276-434	550	138.0	150-720	1.29	0.29	0.67-1.75
	13	16	360	35.8	292-416	560	149.0	250-800	1.20	0.25	0.84-1.75
	14	9	345	30.9	272-382	524	179.0	150-700	1.23	0.31	0.75-1.70
	15	10	365	25.4	304-396	592	140.0	250-800	1.20	0.21	0.89-1.55
	16	5	372	45.1	339-450	639	187.0	400-900	1.23	0.22	0.99-1.41
	17	5	390	29.8	370-443	670	90.8	550-750	1.14	0.18	0.86-1.31
	18	3	412	50.5	375-470	933	493.0	600-1500	1.24	0.17	1.14-1.44
	19	6	364	11.5	344-372	566	93.1	450-700	1.18	0.18	0.87-1.26
	20	4	375	9.6	363-384	831	484.0	500-1550	1.55	0.82	0.96-2.74
	21	4	362	16.3	367-372	525	104.0	400-650	1.10	0.11	1.01-1.26
	22	2	375	12.7	366-384	625	106.0	550-700	1.18	0.08	1.12-1.24
	23	2	410	3.5	407-412	800	0.0	-	1.17	0.04	1.14-1.19
	24	4	366	24.4	346-400	691	61.7	640-775	1.43	0.23	1.09-1.57
	25	1	357	-	-	700	-	-	1.54	-	-
	26	1	375	-	-	600	-	-	1.14	-	-
	27	1	387	-	-	830	-	-	1.43	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	1	387	-	-	600	-	-	1.04	-	-
	30	2	358	4.2	355-361	525	106.0	450-600	1.15	0.19	1.01-1.28
	31	1	386	-	-	700	-	-	1.22	-	-

Appendix D1 . Length, weight and K-value for lake trout by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
LITTLE SALMON	8	1	332	-	-	389	-	-	1.06	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	1	397	-	-	700	-	-	1.12	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	2	444	53.7	406-482	970	353.6	720-1220	1.09	0.01	1.08-1.09
	14	1	530	-	-	1900	-	-	1.28	-	-
	15	5	447	40.6	392-500	1075	299.3	707-1500	1.18	0.06	1.09-1.24
	16	0	-	-	-	-	-	-	-	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	0	-	-	-	-	-	-	-	-	-
	19	1	478	-	-	1187	-	-	1.09	-	-
	20	0	-	-	-	-	-	-	-	-	-
	21	2	427	41.0	398-456	828	323.1	600-1057	1.03	0.11	0.95-1.11
	22	1	505	-	-	1600	-	-	1.24	-	-
	23	0	-	-	-	-	-	-	-	-	-
	24	1	489	-	-	1350	-	-	1.15	-	-
	25	2	433	43.8	402-464	925	388.9	650-1200	1.10	0.14	1.00-1.25
	26	0	-	-	-	-	-	-	-	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	1	757	-	-	6250	-	-	1.44	-	-
	30	1	475	-	-	1300	-	-	1.21	-	-
SNAFU	22	1	660	-	-	8800	-	-	3.06	-	-
ETHEL	8	1	247	-	-	130	-	-	1.00	-	-
	9	1	216	-	-	130	-	-	1.29	-	-
	10	1	235	-	-	126	-	-	0.97	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	0	-	-	-	-	-	-	-	-	-
	14	0	-	-	-	-	-	-	-	-	-
	15	1	424	-	-	1000	-	-	1.31	-	-
	16	0	-	-	-	-	-	-	-	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	0	-	-	-	-	-	-	-	-	-
	19	0	-	-	-	-	-	-	-	-	-
	20	1	455	-	-	1250	-	-	1.33	-	-
	21	3	431	238.7	405-454	1190	101.49	1100-1300	1.49	0.15	1.39-1.66
	22	1	473	-	-	1300	-	-	1.23	-	-
	23	1	443	-	-	1300	-	-	1.40	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	1	439	-	-	1200	-	-	1.42	-	-
	26	1	438	-	-	1000	-	-	1.19	-	-
DEZADEASH	7	1	524	-	-	2100	-	-	1.46	-	-
	8	1	488	-	-	1450	-	-	1.25	-	-
	9	5	495	41.0	456-559	1558	465.6	1180-2290	1.25	0.05	1.19-1.31
	10	1	501	-	-	1710	-	-	1.36	-	-
	11	3	563	108.0	499-688	2583	1451.0	1600-4250	1.36	0.11	1.29-1.49
	12	0	-	-	-	-	-	-	-	-	-
	13	0	-	-	-	-	-	-	-	-	-
	14	0	-	-	-	-	-	-	-	-	-
	15	4	560	34.8	518-602	2375	221.7	2150-2650	1.36	0.14	1.21-1.55
	16	2	569	21.2	554-584	2405	247.5	2230-2580	1.31	0.01	1.30-1.31
	17	3	537	16.5	518-548	2153	250.1	1900-2400	1.39	0.07	1.33-1.46
	18	2	561	27.6	542-581	2325	176.8	2200-2450	1.33	0.30	1.12-1.54
	19	1	610	-	-	3400	-	-	1.50	-	-
	20	2	521	23.3	505-538	1950	212.1	1800-2100	1.38	0.04	1.35-1.40
	21	2	600	36.8	574-626	3305	1124.3	2510-4100	1.50	0.24	1.33-1.67
	22	2	608	12.7	599-617	2665	190.9	2530-2800	1.19	0.01	1.18-1.19
	23	0	-	-	-	-	-	-	-	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	1	580	-	-	2500	-	-	1.28	-	-
	27	1	677	-	-	2850	-	-	0.92	-	-
	28	1	554	-	-	2200	-	-	1.29	-	-

Appendix D. Length, weight and K-value for lake trout by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
FOX	9	1	209	-	-	117	-	-	1.28	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	1	315	-	-	374	-	-	1.20	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	3	342	7.5	334-349	495	47.7	450-545	1.24	0.11	1.12-1.32
	14	3	396	31.1	362-423	693	224.0	540-950	1.11	0.24	0.83-1.26
	15	2	388	31.8	365-410	725	247.5	550-900	1.22	0.13	1.13-1.31
	16	0	-	-	-	-	-	-	-	-	-
	17	2	390	16.3	379-402	590	71.0	540-640	1.01	0.25	0.83-1.18
	18	2	373	24.7	356-391	616	161.2	502-730	1.17	0.08	1.11-1.22
	19	0	-	-	-	-	-	-	-	-	-
	20	1	468	-	-	1320	-	-	1.29	-	-
	21	3	517	181.1	394-725	2425	281.1	730-5670	1.26	0.21	1.09-1.49
	22	0	-	-	-	-	-	-	-	-	-
	23	2	430	62.9	385-474	950	254.6	770-1130	1.21	0.21	1.06-1.35
	24	0	-	-	-	-	-	-	-	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	1	483	-	-	1310	-	-	1.16	-	-
MAYO	13	1	425	-	-	800	-	-	1.04	-	-
	14	1	496	-	-	1585	-	-	1.29	-	-
LITTLE ATLIN	5	1	261	-	-	195	-	-	1.10	-	-
	6	0	-	-	-	-	-	-	-	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	0	-	-	-	-	-	-	-	-	-
	14	0	-	-	-	-	-	-	-	-	-
	15	0	-	-	-	-	-	-	-	-	-
	16	1	508	-	-	1701	-	-	1.30	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	0	-	-	-	-	-	-	-	-	-
	19	0	-	-	-	-	-	-	-	-	-
	20	1	508	-	-	2045	-	-	1.56	-	-
	21	0	-	-	-	-	-	-	-	-	-
	22	0	-	-	-	-	-	-	-	-	-
	23	0	-	-	-	-	-	-	-	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	0	-	-	-	-	-	-	-	-	-
	26	1	499	-	-	1932	-	-	1.55	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	1	587	-	-	2818	-	-	1.39	-	-
MICHIE	12	1	451	-	-	1137	-	-	1.24	-	-
	13	1	527	-	-	1681	-	-	1.15	-	-
	14	0	-	-	-	-	-	-	-	-	-
	15	2	252	108.2	175-328	200	212.1	50-350	0.96	0.04	0.93-0.99
	16	0	-	-	-	-	-	-	-	-	-
	17	0	-	-	-	-	-	-	-	-	-
	18	0	-	-	-	-	-	-	-	-	-
	19	0	-	-	-	-	-	-	-	-	-
	20	1	575	-	-	2585	-	-	1.36	-	-
	21	0	-	-	-	-	-	-	-	-	-
	22	0	-	-	-	-	-	-	-	-	-
	23	0	-	-	-	-	-	-	-	-	-
	24	0	-	-	-	-	-	-	-	-	-
	25	1	508	-	-	1470	-	-	1.12	-	-
	26	0	-	-	-	-	-	-	-	-	-
	27	0	-	-	-	-	-	-	-	-	-
	28	0	-	-	-	-	-	-	-	-	-
	29	0	-	-	-	-	-	-	-	-	-
	30	1	704	-	-	5650	-	-	1.62	-	-
	31	1	587	-	-	2900	-	-	1.43	-	-

Appendix D2 .Length , weight and K-value for pike by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
TAYE	4	1	421	-	-	500	-	-	0.67	-	-
	5	1	467	-	-	600	-	-	0.59	-	-
	6	7	471	36.4	434-541	707	142.7	550-1000	0.67	0.08	0.59-0.79
	7	5	506	43.5	445-561	980	120.4	850-1150	0.76	0.14	0.59-0.96
	8	5	541	15.0	522-560	992	129.9	880-1200	0.63	0.07	0.53-0.6
	9	3	538	27.5	521-570	1016	125.8	900-1150	0.66	0.14	0.54-0.8
WOLF	NO AGE	1	674	-	-	2750	-	-	0.89	-	-
SNAFU	1	1	199	-	-	25	-	-	0.32	-	-
	2	1	232	-	-	20	-	-	0.40	-	-
	3	0	-	-	-	-	-	-	-	-	-
	4	0	-	-	-	-	-	-	-	-	-
	5	0	-	-	-	-	-	-	-	-	-
	6	3	541	74.7	455-590	1133	404.1	700-1500	0.70	0.07	0.62-0.74
	7	4	542	67.9	480-625	1231	466.1	825-1750	0.75	0.05	0.71-0.81
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	3	647	101.7	542-745	2283	957.0	1400-3300	0.82	0.06	0.77-0.88
	11	0	-	-	-	-	-	-	-	-	-
	12	1	618	-	-	1600	-	-	0.68	-	-
CLAIRE	2	1	163	-	-	169	-	-	3.90	-	-
	3	0	-	-	-	-	-	-	-	-	-
	4	1	515	-	-	950	-	-	0.70	-	-
	5	2	541	86.9	479-602	1295	643.5	840-1750	0.78	0.03	0.76-0.80
	6	3	593	33.1	558-624	1863	222.8	1720-2120	0.90	0.10	0.81-1.01
	7	0	-	-	-	-	-	-	-	-	-
	8	2	680	1.4	679-681	2475	35.4	2450-2500	0.79	0.00	0.78-0.79
	9	2	766	76.4	712-820	4050	1343.5	3100-5000	0.48	0.54	0.09-0.86
	10	0	-	-	-	-	-	-	-	-	-
	11	2	889	91.2	825-954	6375	1449.6	5350-7400	0.90	0.07	0.85-0.95
DEZADEASH	8	1	680	-	-	726	-	-	0.91	-	-
LITTLE ATLIN	5	1	470	-	-	1000	-	-	0.96	-	-
	6	1	678	-	-	3272	-	-	1.05	-	-
	7	2	535	120.2	450-620	1400	848.5	800-2000	0.86	0.03	
	8	5	553	31.8	501-586	1420	284.2	950-1700	0.83	0.10	0.76-0.99
	9	4	609	25.4	580-639	1725	377.5	1200-2000	0.76	0.14	0.56-0.87
	10	9	576	87.9	435-680	1780	800.9	1000-3100	0.89	0.14	0.74-1.21
	11	3	673	37.6	640-714	2433	585.9	2000-3100	0.79	0.06	0.75-0.85
	12	2	772	116.7	501-855	4495	2962.8	2400-6590	0.89	0.23	0.73-1.05
ETHEL	6	1	574	-	-	1350	-	-	0.71	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	1	596	-	-	1750	-	-	0.83	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	2	754	198.7	614-895	4275	2722.4	2350-6200	0.94	0.11	0.86-1.02
BIG KALZAS	6	1	590	-	-	1600	-	-	0.78	-	-
TWIN WEST	1	1	150	-	-	25	-	-	0.74	-	-
	2	0	-	-	-	-	-	-	-	-	-
	3	0	-	-	-	-	-	-	-	-	-
	4	0	-	-	-	-	-	-	-	-	-
	5	1	472	-	-	1050	-	-	1.00	-	-
	6	1	408	-	-	600	-	-	0.88	-	-
	7	1	582	-	-	1500	-	-	0.76	-	-
	8	1	531	-	-	950	-	-	0.63	-	-
	9	1	602	-	-	1830	-	-	0.84	-	-
	10	3	580	93.0	474-648	2116	305.5	1850-2450	1.17	0.49	0.87-1.74
	11	1	585	-	-	1800	-	-	0.90	-	-
	12	1	756	-	-	3300	-	-	0.76	-	-
	13	0	0	-	-	-	-	-	-	-	-
	14	1	649	-	-	2250	-	-	0.82	-	-
	15	1	947	-	-	6400	-	-	0.75	-	-

Appendix D2 .Length, weight and K-value for pike by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE
FOX	4	1	461	-	-	630	-	-	0.64	-	-
	5	3	500	17.3	486-520	917	66.6	860-990	0.73	0.03	0.70-0.77
	6	0	-	-	-	-	-	-	-	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	2	563	61.5	520-604	1450	381.8	1180-1720	0.81	0.05	0.77-0
MICHIE	6	1	428	-	-	620	-	-	0.79	-	-
	7	2	634	67.2	587-682	1575	388.9	1300-1850	0.61	0.04	0.58-0.64
	8	1	540	-	-	1000	-	-	0.64	-	-
	9	1	662	-	-	1600	-	-	0.55	-	-
	10	1	544	-	-	931	-	-	0.58	-	-
	11	2	582	101.8	510-654	1339	479.4	1000-1678	0.68	0.11	0.60-0.75
	12	0	-	-	-	-	-	-	-	-	-
	13	0	-	-	-	-	-	-	-	-	-
	14	1	738	-	-	4950	-	-	1.23	-	-
LITTLE SALMON	8	1	764	-	-	3500	-	-	0.78	-	-

Appendix D3 .Length, weight and K-value for least cisco by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE	$\bar{Y}$	SD	RANGE
QUIET	1	12	151	23.7	134-200	39	21.6	25-90	1.07	0.12	0.87-1.25
	2	17	201	16.2	172-230	91	24.8	55-150	1.10	0.07	0.95-1.23
	3	4	231	18.0	209-251	138	27.5	110-170	1.10	0.07	1.04-1.20
TWIN	1	4	169	11.5	158-185	42	11.9	25-50	0.93	0.36	0.39-1.14
	2	7	200	11.0	188-221	103	26.0	76-150	1.26	0.15	1.11-1.52
	3	8	242	17.0	202-255	178	38.8	100-225	1.24	0.15	1.05-1.43
	4	6	256	5.0	251-265	250	101.2	175-450	1.48	0.58	1.11-2.65
	5	5	264	10.2	250-278	245	37.0	200-300	1.34	0.20	1.10-1.60
LITTLE SALMON	4	1	317	-	-	350	-	-	1.10	-	-
SNAFU	2	31	206	18.6	170-250	111	39.0	25-150	1.22	0.29	0.45-1.62
	3	26	220	9.3	200-250	133	25.9	100-170	1.27	0.31	0.77-1.87
	4	2	245	7.0	240-250	150	-	-	1.03	0.09	0.96-1.09
LITTLE ATLIN	4	1	246	-	-	150	-	-	1.01	-	-

Appendix D. Length, weight and K-value for grayling by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
CLAIRE	1	2	159	15.5	148-170	52	3.5	50-55	1.33	0.29	1.12-1.54
	2	6	222	12.9	204-242	134	31.8	99-190	1.21	0.10	1.05-1.34
	3	2	321	49.3	281-306	376	157.7	225-320	1.14	0.06	1.12-1.15
	4	30	319	224.7	290-355	377	48.2	280-480	1.15	0.06	1.03-1.27
	5	7	359	16.6	339-380	503	57.2	430-578	1.08	0.05	1.00-1.13
WOLF	2	3	223	48.4	187-278	130	103.2	62-249	1.02	0.12	0.94-1.16
	3	7	184	28.1	193-273	153	53.8	75-225	1.06	0.04	0.99-1.10
	4	6	274	33.7	234-316	241	92.9	125-370	1.12	0.08	0.97-1.19
	5	2	362	12.0	353-370	496	56.6	455-535	1.07	0.05	1.03-1.10
	6	3	374	7.5	367-382	591	43.1	560-640	1.13	0.03	1.10-1.15
	7	2	355	10.6	347-362	508	81.3	450-565	1.13	0.09	1.07-1.19
	8	1	387	-	-	635	-	-	1.10	-	-
JOJO	3	3	257	9.5	248-267	106	40.4	70-150	0.62	0.17	0.46-0.79
	4	1	329	-	-	350	-	-	0.98	-	-
	5	9	334	1.7	307-355	387	104.0	220-550	1.02	0.17	0.76-1.12
	6	3	344	10.1	335-355	416	28.9	400-450	1.02	0.12	0.89-1.12
	7	1	410	-	-	820	-	-	1.19	-	-
	8	1	393	-	-	720	-	-	1.19	-	-
FOX	1	16	123	11.1	101-138	66	9.0	50-180	3.62	0.52	1.37-4.85
	2	2	251	21.2	236-266	270	127.3	180-360	1.64	0.38	1.37-1.91
	3	10	310	21.4	274-346	380	49.7	320-450	1.29	0.15	1.09-1.56
	4	2	350	21.9	334-365	500	56.6	460-540	1.17	0.08	1.11-1.23
	5	9	369	15.1	351-388	549	56.1	490-640	1.09	0.12	0.92-1.25
	6	0	-	-	-	-	-	-	-	-	-
	7	1	365	-	-	720	-	-	1.48	-	-
QUIET	1	29	129	8.8	115-150	24	6.0	10-40	1.14	0.22	0.66-1.64
	2	0	-	-	-	-	-	-	-	-	-
	3	6	297	17.8	264-309	310	56.9	200-350	1.19	0.07	1.10-1.27
	4	9	320	33.3	278-358	394	110.0	250-530	1.17	0.05	1.09-1.25
	5	5	368	24.2	328-393	557	122.0	350-660	1.10	0.12	0.99-1.28
	6	1	341	-	-	515	-	-	1.30	-	-
ALLIGATOR	1	25	121	6.90	110-133	20	2.2	17-25	1.17	0.09	1.00-1.08
	2	20	220	27.2	163-270	134	37.3	40-150	1.24	0.33	0.76-2.19
	3	18	251	35.3	212-369	212	115.2	150-600	1.28	0.23	0.93-1.81
	4	4	327	30.9	295-367	362	165.2	150-550	1.11	0.55	0.30-1.48
	5	16	357	30.7	310-419	641	116.0	450-850	1.40	0.15	1.16-1.65
	6	16	386	14.7	365-414	762	109.6	600-1000	1.32	0.11	1.17-1.65
	7	11	390	12.2	382-411	789	90.6	600-950	1.32	0.14	1.15-1.54
	8	3	400	7.8	392-407	740	96.4	670-850	1.14	0.10	1.07-1.26
ETHEL	1	2	123	11.3	115-131	19	4.9	16-23	1.04	0.02	1.02-1.05
	2	1	186	-	-	75	-	-	1.17	-	-
	3	4	292	25.6	262-323	347	148.2	180-540	1.32	0.25	1.00-1.38
	4	1	349	-	-	600	-	-	1.41	-	-
	5	1	364	-	-	500	-	-	1.04	-	-
	6	2	405	29.7	384-426	800	212.1	650-950	1.13	0.06	1.15-1.23
	7	1	410	-	-	850	-	-	1.23	-	-

Appendix D3 . Length, weight and K-value for humpback whitefish by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
WOLF	4	1	302	-	-	363	-	-	1.32	-	-
	5	1	308	-	-	332	-	-	1.14	-	-
	6	1	430	-	-	1230	-	-	1.55	-	-
	7	8	420	29.1	386-462	1078	218.3	801-1451	1.44	0.11	1.29-1.6
	8	5	421	15.6	402-441	1011	124.3	815-1160	1.35	0.08	1.25-1.47
	9	3	448	17.5	433-467	1295	186.3	1100-1471	1.44	0.18	1.27-1
	10	0	-	-	-	-	-	-	-	-	-
	11	2	505	12.0	496-513	1830	49.5	1795-1865	1.43	0.06	1.38-1.47
ETHEL	5	3	336	41.4	289-366	590	215.2	370-800	1.43	0.18	1.35-1.63
	6	6	376	10.8	363-390	820	88.3	720-950	1.53	0.09	1.45-1.70
	7	6	398	19.9	360-445	922	250.3	650-1250	1.47	0.32	1.17-2.04
	8	4	441	5.9	433-447	1155	49.3	1100-1220	1.34	0.09	1.23-1.41
	9	8	426	28.2	379-447	1217	315.4	800-1800	1.55	0.23	1.39-2.11
	10	8	437	11.8	428-462	1206	105.0	1100-1350	1.44	0.09	1.32-1.56
	11	3	452	14.2	440-468	1266	76.4	1200-1350	1.37	0.04	1.32-1.41
MAYO	5	1	328	-	-	455	-	-	1.29	-	-
	6	1	361	-	-	700	-	-	1.49	-	-
	7	1	360	-	-	600	-	-	1.29	-	-
	8	8	375	48.6	275-429	759	202.5	550-1020	1.44	0.66	1.14-3.13
	9	7	387	17.1	372-421	813	185.3	600-1150	1.40	0.16	1.15-1.59
	10	2	422	12.0	413-430	1040	127.3	950-1130	1.37	0.05	1.35-1.42
	11	2	413	21.2	398-428	885	120.2	800-970	1.26	0.02	1.24-1.27
	12	1	424	-	-	1120	-	-	1.47	-	-
FOX	4	5	405	22.5	374-435	810	153.5	540-910	1.21	0.14	1.03-1.38
	5	25	413	21.4	380-468	841	151.1	675-1410	1.19	0.14	0.77-1.38
	6	22	440	26.3	394-489	975	149.2	720-1220	1.14	0.08	0.99-1.28
	7	6	450	33.9	408-504	1133	295.2	860-1650	1.22	0.05	1.16-1.29
	8	4	481	23.3	460-514	1303	219.1	1180-1630	1.17	0.05	1.10-1.20
	9	1	434	-	-	1040	-	-	1.11	-	-
SNAFU	5	1	314	-	-	420	-	-	1.36	-	-
	6	1	321	-	-	350	-	-	1.06	-	-
	7	2	318	31.8	295-340	390	155.6	280-500	1.18	0.13	1.09-1.27
	8	7	332	23.7	306-365	414	98.6	300-570	1.12	0.11	1.04-1.32
	9	3	343	28.1	314-370	457	128.9	350-600	1.11	0.08	1.02-1.18
	10	2	342	30.0	321-363	470	70.7	420-520	1.18	0.13	1.09-1.27
	11	1	370	-	-	620	-	-	1.22	-	-
LITTLE SALMON	7	3	432	33.9	394-459	1300	141.4	800-1400	1.38	0.07	1.31-1.45
	8	12	443	19.5	402-479	1189	254.0	820-1700	1.35	0.15	1.18-1.66
	9	6	426	31.4	388-467	1086	241.6	750-1389	1.38	0.11	1.28-1.56
	10	6	460	30.3	411-502	1316	239.2	980-1650	1.34	0.06	1.25-1.41
	11	1	494	-	-	1500	-	-	1.24	-	-
DEZADEASH	3	3	222	16.1	210-240	153	32.2	125-188	1.46	0.57	0.90-2.03
	4	8	258	20.4	231-284	206	44.1	145-265	1.19	0.14	1.04-1.49
	5	15	265	8.3	249-276	314	34.0	162-265	1.15	0.15	0.86-1.34
	6	9	300	23.5	261-325	326	73.2	210-450	1.19	0.11	1.02-1.32
	7	14	317	37.0	260-389	387	133.3	200-650	1.17	0.10	1.02-1.34
	8	7	333	13.6	320-359	431	94.4	330-600	1.15	0.11	1.01-1.30
	9	7	331	37.1	288-398	474	170.0	270-750	1.27	0.16	1.13-1.56
	10	2	353	67.9	305-401	673	173.2	550-795	1.59	0.50	1.23-1.94
	11	3	367	59.9	319-434	580	326.9	330-950	1.09	0.07	1.02-1.16
	12	1	410	-	-	650	-	-	0.94	-	-
TWIN WEST	2	9	173	9.6	159-185	51	6.2	43-64	1.03	0.08	0.89-1.13
	3	14	224	25.8	195-249	116	32.9	76-176	1.02	0.15	0.66-1.31
	4	5	245	12.3	235-262	164	20.2	146-198	1.12	0.13	0.92-1.27
	5	8	313	20.5	266-330	395	65.4	270-493	1.28	0.11	1.16-1.43
	6	5	406	19.9	373-422	928	141.9	758-1086	1.38	0.13	1.21-1.55
	7	5	403	14.1	384-419	969	156.5	840-1237	1.48	0.12	1.37-1.68
	8	6	418	16.6	389-436	1088	121.1	900-1250	1.48	0.07	1.39-1.59
	9	5	438	12.7	421-454	1211	98.1	1043-1291	1.45	0.08	1.34-1.52
	10	3	428	13.5	414-441	1385	372.1	1005-1750	1.76	0.41	1.42-2.22
	11	1	478	-	-	1250	-	-	1.14	-	-

Appendix D s. Length, weight and K-value for humpback whitefish by age class. (Continued.)

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
QUIET	3	1	268	-	-	230	-	-	1.19	-	-
	4	1	358	-	-	570	-	-	1.24	-	-
	5	0	-	-	-	-	-	-	-	-	-
	6	3	396	24.9	367-412	728	55.3	670-780	1.19	0.15	1.05-1.36
	7	4	439	33.5	415-486	1094	254.0	860-1450	1.31	0.32	0.94-1.71
	8	5	458	45.9	388-515	1401	389.4	760-1700	1.41	0.17	1.22-1.65
	9	8	458	29.3	402-490	1300	287.9	785-1630	1.34	0.13	1.10-1.49
	10	4	481	17.9	458-500	1293	191.0	1088-1543	1.17	0.15	0.94-1.28
MICHIE	4	2	271	14.9	260-281	225	35.4	200-250	1.14	0.01	1.13-1.14
	5	2	298	33.2	274-321	340	93.3	274-406	1.28	0.07	1.23-1.33
	6	9	322	28.2	269-358	413	100.0	260-558	1.25	0.29	0.87-1.97
	7	9	342	14.4	322-362	535	80.6	400-648	1.17	0.09	1.20-1.47
	8	17	376	41.8	310-470	680	243.6	400-1250	1.27	0.18	0.67-1.46
	9	7	365	25.9	333-408	665	152.7	498-950	1.36	0.15	1.13-1.54
	10	6	383	40.4	329-426	723	248.6	396-1050	1.24	0.13	1.06-1.38
	11	0	-	-	-	-	-	-	-	-	-
	12	1	463	-	-	1150	-	-	1.16	-	-
LITTLE ATLIN	1	8	124	4.7	120-132	19	1.8	15-20	1.01	0.11	0.87-1.16
	2	10	156	25.4	134-213	43	28.1	26-117	1.19	0.15	0.96-1.35
	3	15	204	16.6	160-225	104	21.2	52-142	1.22	0.07	1.12-1.34
	4	8	239	22.2	200-274	173	42.7	92-218	1.25	0.13	1.06-1.45
	5	3	333	88.9	326-343	463	61.6	400-523	1.25	0.13	1.11-1.35
	6	9	346	43.8	300-427	599	298.8	378-1264	1.36	0.17	1.08-1.62
	7	16	403	22.3	360-436	919	175.6	550-1150	1.39	0.14	1.18-1.67
	8	28	415	26.2	344-451	1009	187.5	671-1444	1.41	0.17	1.12-1.80
	9	13	423	25.0	376-454	1119	189.1	761-1421	1.48	0.18	1.12-1.80
	10	8	435	18.9	413-469	1154	143.6	973-1394	1.41	0.18	1.11-1.68
	11	3	429	24.5	404-453	1116	153.8	948-1250	1.41	0.06	1.34-1.44
	12	2	468	10.6	460-475	1650	70.7	1600-1700	1.62	0.18	1.49-1.75

Appendix De. Length, weight and K-value for round whitefish by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
DEZADEASH	3	2	250	7.8	245-256	153	10.6	145-160	0.97	0.30	0.95-0.99
	4	12	252	23.6	228-305	147	50.1	100-270	0.89	0.05	0.82-0.96
	5	7	277	27.0	235-314	193	57.5	109-270	0.88	0.05	0.84-0.97
	6	5	298	16.8	271-315	313	33.1	270-360	1.18	0.10	1.11-1.36
	7	1	311	-	-	250	-	-	0.83	-	-
	8	2	340	12.7	331-349	415	13.1	335-495	1.04	0.17	0.92-1.16
WOLF	1	32	133	9.4	121-174	15	33.1	5-35	0.61	0.18	0.28-0.9
	2	6	195	25.6	164-231	59	29.1	31-95	0.73	0.09	0.63-0.8
	3	5	220	22.0	187-247	90	33.5	70-132	0.82	0.09	0.75-0.9
	4	4	265	18.9	244-284	158	40.1	122-210	0.83	0.11	0.72-0
	5	8	315	17.7	290-345	303	47.1	261-385	0.97	0.05	0.88-1
	6	16	337	34.9	252-413	366	119.9	140-675	0.93	0.07	0.57-1.0
	7	9	367	18.7	340-399	488	80.8	336-612	0.98	0.24	0.83-1.04
	8	5	377	16.5	321-399	611	122.8	476-725	1.13	0.15	0.96-1.37
ETHEL	1	2	124	7.1	119-129	17	5.6	13-21	0.88	0.15	0.77-0.98
	2	7	158	8.0	147-165	36	6.9	25-44	0.89	0.06	0.79-0.98
	3	5	223	25.9	205-262	111	53.2	80-200	0.95	0.14	0.80-1.11
	4	20	283	31.9	200-333	244	114.9	106-620	1.09	0.65	0.76-3.83
	5	9	306	20.4	261-327	291	63.7	180-400	0.99	0.11	0.82-1.20
	6	10	328	16.5	303-353	339	94.5	200-450	0.94	0.17	0.65-1.16
	7	9	340	11.8	317-356	458	95.8	350-650	1.16	0.18	0.95-1.58
	8	2	363	0.7	362-363	500	0	-	1.05	0	-
FOX	2	1	185	-	-	180	-	-	2.85	-	-
	3	0	-	-	-	-	-	-	-	-	-
	4	2	280	7.1	275-285	265	63.6	220-310	1.20	0.20	1.06-1.34
	5	3	316	16.0	299-331	377	28.9	360-410	1.21	0.20	0.99-1.35
	6	11	341	12.0	326-371	407	94.5	160-540	1.02	0.22	0.44-1.30
	7	3	356	23.1	330-374	492	94.6	425-600	1.10	0.05	0.81-1.25
LITTLE ATLIN	2	3	179	18.7	165-200	58	20.8	40-81	0.99	0.10	0.89-1.00
	3	9	220	31.7	190-293	109	60.4	32-264	1.00	0.07	0.89-1.08
	4	5	252	14.5	234-274	159	34.5	115-210	0.98	0.05	0.90-1.03
	5	7	239	40.2	183-278	149	61.4	33-230	1.04	0.10	0.86-1.19
	6	1	281	-	-	232	-	-	1.05	-	-
MAYO	1	7	144	43.7	99-207	42	31.3	10-80	1.41	0.28	0.90-1.71
	2	1	227	-	-	160	-	-	1.37	-	-
	3	2	277	2.1	275-278	200	0	-	1.04	0.02	0.93-0.96
	4	1	312	-	-	315	-	-	0.94	-	-
	5	2	328	14.9	317-338	490	70.7	440-540	1.39	0.01	1.38-1.39
	6	2	364	19.8	350-378	450	70.7	400-500	0.93	0	-
	7	1	430	-	-	750	-	-	0.94	-	-
	8	1	391	-	-	600	-	-	1.00	-	-
LITTLE SALMON	6	2	377	16.3	365-388	575	106.1	500-650	1.07	0.06	1.03-1.11
	7	4	380	8.7	368-388	613	85.4	500-700	1.11	0.09	1.00-1.20
	8	3	421	62.9	375-493	677	68.1	600-730	0.96	0.30	0.61-1.14
	9	3	414	13.9	402-429	780	103.9	720-900	1.10	0.05	1.04-1.14
QUIET	1	10	143	24.6	121-190	32	18.0	20-70	1.01	0.08	0.91-1.13
	2	6	236	11.7	213-245	129	19.6	90-140	0.98	0.05	0.92-1.04
	3	17	243	16.5	198-264	142	25.7	80-180	0.98	0.09	0.82-1.07
	4	28	291	28.9	234-349	232	76.8	130-430	0.99	0.08	0.87-1.30
	5	29	318	19.3	221-349	309	53.9	100-430	0.95	0.08	0.87-1.08
	6	16	344	11.0	323-364	413	44.5	340-480	1.01	0.05	0.91-1.07
	7	10	360	20.6	337-403	461	107.4	362-700	0.98	0.07	0.82-1.07
	8	2	369	13.4	360-379	465	7.1	460-470	0.93	0.12	0.84-1.01
BIG KALZAS	3	1	252	-	-	175	-	-	1.09	-	-
	4	1	304	-	-	270	-	-	0.96	-	-
	5	1	316	-	-	335	-	-	1.06	-	-
	6	1	381	-	-	570	-	-	1.03	-	-
	7	4	384	17.2	366-399	605	99.8	510-710	1.07	0.04	1.03-1.12
	8	4	419	15.9	404-436	789	53.9	710-830	1.07	0.08	1.00-1.19
	9	5	394	49.5	323-439	721	212.1	430-985	1.16	0.12	0.97-1.28
	10	3	431	23.6	413-458	895	170.6	755-1085	1.11	0.03	1.02-1.13
CLAIRE	1	1	149	-	-	50	-	-	1.51	-	-
	2	1	199	-	-	81	-	-	1.03	-	-
	3	5	268	13.8	249-280	213	42.3	150-261	1.10	0	-
	4	7	307	9.9	298-322	299	29.5	260-349	1.03	0	0.98-1.06
	5	5	332	30.1	304-379	411	136.4	285-630	1.09	0.10	0.92-1.18
	6	4	349	30.4	306-374	458	87.4	341-540	1.07	0	-
	7	4	385	404.4	355-399	654	144.0	450-785	1.13	0.02	1.01-1.31

Appendix D7. Length, weight and K-value for broad whitefish by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
SNAFU	6	3	295	9.1	287-305	263	23.1	250-290	1.02	0.04	0.98-1.0
	7	1	310	-	-	320	-	-	1.07	-	-
	8	4	315	7.3	309-325	330	47.6	300-400	1.06	0.08	1.01-1.17
	9	1	325	-	-	350	-	-	1.02	-	-
LITTLE SALMON	1	2	137	2.1	135-138	27	4.9	23-30	1.05	0.24	0.88-1
	2	0	-	-	-	-	-	-	-	-	-
	3	0	-	-	-	-	-	-	-	-	
	4	0	-	-	-	-	-	-	-	-	
	5	0	-	-	-	-	-	-	-	-	-
	6	0	-	-	-	-	-	-	-	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	1	395	-	-	800	-	-	1.30	-	-
MICHIE	5	2	267	20.5	252-281	250	70.7	200-300	1.30	0.07	1.25-1.35
	6	0	-	-	-	-	-	-	-	-	-
	7	1	326	-	-	450	-	-	1.24	-	-

Appendix D8. Length, weight and K-value for burbot by age class.

			FORK LENGTH (mm)			WEIGHT (g)			K		
LAKE	AGE	N	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE	$\bar{X}$	SD	RANGE
QUIET	6	2	317	8.5	311-323	310	56.6	270-350	0.97	0.10	0.90-1.04
	7	1	222	-	-	300	-	-	2.74	-	-
	8	2	381	86.3	320-442	530	184.0	400-660	0.99	0.32	0.76-1.22
	9	3	414	47.1	360-442	642	25.7	635-670	0.95	0.35	0.72-0.83
	10	1	478	-	-	890	-	-	0.81	-	-
	11	1	483	-	-	1020	-	-	0.82	-	-
SEKULMUN	4	2	272	31.1	291-327	181	63.6	136-226	0.60	0.07	.55-.65
	5	0	-	-	-	-	-	-	-	-	-
	6	1	249	-	-	113	-	-	0.47	-	-
	7	0	-	-	-	-	-	-	-	-	-
	8	0	-	-	-	-	-	-	-	-	-
	9	1	394	-	-	771	-	-	0.91	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	1	457	-	-	1315	-	-	0.85	-	-
FOX	9	1	477	-	-	923	-	-	.85	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	0	-	-	-	-	-	-	-	-	-
	12	0	-	-	-	-	-	-	-	-	-
	13	0	-	-	-	-	-	-	-	-	-
	14	1	527	-	-	1153	-	-	.79	-	-
BIG KALZAS	4	2	242	15.5	231-253	77	10.6	70-85	0.55	0.04	.52-.57
	5	0	-	-	-	-	-	-	-	-	-
	6	0	-	-	-	-	-	-	-	-	-
	7	2	441	65.1	395-487	545	304.1	330-769	0.60	0.09	.54-.66
	8	0	-	-	-	-	-	-	-	-	-
	9	0	-	-	-	-	-	-	-	-	-
	10	0	-	-	-	-	-	-	-	-	-
	11	1	537	-	-	850	-	-	0.55	-	-
LITTLE ATLIN	6	1	434	-	-	700	-	-	0.86	-	-
	7	3	396	58.1	331-442	611	276.2	300-820	0.92	0.08	0.83-0.98
	8	1	420	-	-	624	-	-	0.84	-	-
	9	3	411	41.2	368-450	739	133.7	601-748	1.07	0.13	1.04-1.21
	10	2	544	82.0	486-602	1495	455.4	1174-1818	0.93	0.13	0.83-1.02
	11	2	513	29.7	492-534	1365	2.8	1363-1367	1.03	0.18	0.90-1.15

Appendix E.

Natural Log Equation relationships between age and weight.

Appendix E. Natural Log Equation relationships between age and weight.

SPECIES	LAKE	GROWTH EQUATION WEIGHT (y) AND AGE (x)	
Lake trout	Alligator	ln y = ln x (0.98) + 4.03	r = 0.69
	Big Kalzas	ln y = ln x (1.83) + 1.60	r = 0.93
	Claire	ln y = ln x (1.93) + 1.55	r = 0.87
	Coghlan	ln y = ln x (1.80) + 2.10	r = 0.77
	Ethel	ln y = ln x (2.20) + 0.26	r = 0.94
	Fox	ln y = ln x (1.88) + 1.29	r = 0.72
	Jojo	ln y = ln x (1.41) + 2.57	r = 0.68
	Quiet	ln y = ln x (2.09) + 1.13	r = 0.92
	Twin (West)	ln y = ln x (3.80) - 3.30	r = 0.92
Least cisco	Quiet	ln y = ln x (1.40) + 3.60	r = 0.88
	Twin (West)	ln y = ln x (1.20) + 3.80	r = 0.91
Broad whitefish	Snafu	ln y = ln x (0.73) + 4.28	r = 0.76
Northern pike	Taye	ln y = ln x (1.00) + 4.82	r = 0.80
	Twin (West)	ln y = ln x (1.85) + 3.40	r = 0.96
Arctic grayling	Alligator	ln y = ln x (1.97) + 3.30	r = 0.96
	Claire	ln y = ln x (1.44) + 3.93	r = 0.97
	Ethel	ln y = ln x (2.04) + 3.18	r = 0.95
	Fox	ln y = ln x (1.36) + 4.25	r = 0.97
	Jojo	ln y = ln x (2.06) + 2.53	r = 0.8[illegible]
	Quiet	ln y = ln x (2.00) + 3.19	r = 0.98
	Wolf	ln y = ln x (1.79) + 3.02	r = 0.91
Burbot	Little Atlin	ln y = ln x (1.67) + 3.15	r = 0.6[illegible]
	Quiet	ln y = ln x (2.09) + 1.88	r = 0.9[illegible]

SPECIES	LAKE	GROWTH EQUATION WEIGHT (y) AND AGE (x)	
Humpback Whitefish	Dezadeash	ln y = ln x (1.17) + 3.70	r = 0.76
	Ethel	ln y = ln x (0.94) + 5.00	r = 0.74
	Fox	ln y = ln x (0.49) + 6.00	r = 0.83
	Little Atlin	ln y = ln x (1.98) + 2.65	r = 0.96
	Mayo	ln y = ln x (0.87) + 4.80	r = 0.63
	Michie	ln y = ln x (1.26) + 3.77	r = 0.74
	Twin (West)	ln y = ln x (2.20) + 2.37	r = 0.97
	Wolf	ln y = ln x (1.52) + 3.88	r = 0.82
Round whitefish	Big Kalzas	ln y = ln x (1.28) + 3.86	r = 0.89
	Claire	ln y = ln x (1.23) + 3.95	r = 0.93
	Ethel	ln y = ln x (1.84) + 2.64	r = 0.92
	Fox	ln y = ln x (0.80) + 4.57	r = 0.67
	Little Salmon	ln y = ln x (0.78) + 4.91	r = 0.69
	Mayo	ln y = ln x (1.59) + 3.45	r = 0.90
	Quiet	ln y = ln x (1.39) + 3.48	r = 0.94
	Wolf	ln y = ln x (1.83) + 2.62	r = 0.98